Capacity with a pOsitive enviRonmEntal and societAL footprInt: portS in the future era

COREALIS
THE PORT OF THE FUTURE

D.1.2: COREALIS Personas and Stakeholder classification

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List of Acronyms

Abbreviation / acronym	Description
5G	Fifth Generation of mobile telecoms technology
COREALIS	Capacity with a pOsitive enviRonmEntal and societAL footprInt: portS in the future era—this project
CT	Container Terminal
D1.1	Deliverable number 1 belonging to WP 1
EC	European Commission
ETA	Expected Time of Arrival
EU	European Union
GDPR	General Data Protection Rule (privacy handling within EU)
ITS	ICT in combination with Transport Systems technologies
KoM	Kick off Meeting
KPI	Key Performance Indicator
Lipasto	The unit emission database covers emission factors for road, rail, waterborne and air transport as well as working machines.
PoF	Port of the Future (COREALIS innovations applied)
R&D	Research and Development
ROI	Return on Investment
SME	Small and Medium Enterprise
SurveyMonkey	www.surveymonkey.com
WP	Work Package

Table 1 List of Acronyms

Executive Summary

The continuous and anticipated future growth of containerization increases the need of efficient planning in port operations. There is the need for ports to be adapted to the current trends in global trade. At the same time, the challenges that ports face are only getting greater. Cargo volumes are increasing while the number of vessels is decreasing: Post-Panamax vessels have a capacity of more than 18,000 containers[1]. Port operators need to comply with the increasingly stricter environmental regulations and societal views of sustainability.

The COREALIS vision for ports is to minimise their environmental footprint on the city and decrease disturbances to local populations by reducing congestion around the port. In this way, the port will become a pillar of business innovation, promoting local start-ups specialising in disruptive technologies of mutual interest.

This Deliverable D1.2 is a comprehensive report on the identification and profiling of the smart port-city stakeholders in the COREALIS port-cities, their business/operational profile and the areas of intervention and interaction within the COREALIS framework and innovations. The initial list of stakeholders was established during proposal preparation and it was expanded in the first months of project activity in project meetings, Focus Groups meetings, questionnaire and interviews.

Whilst formulating analysis of COREALIS business models and impacts we considered an extended port community. By mapping and prioritising the stakeholder list, the 5 preliminary COREALIS personas were revised and extended to a larger, yet manageable set of 12 personas. Around those representative personas, the scenarios describing the implementation of the project innovations in the 5 LLs will be developed and implemented.

Deliverable D1.2 also provides a comprehensive study of smart port-city stakeholders' business/operational profiles and areas of intervention and interaction in the COREALIS port-cities. Data collection for the study was carried out using two methods: questionnaire analysis and interviews. The main results came from the analysis of a questionnaire submitted predominantly to ERTICO's network of 1,400 GDPR compliant contacts. A response rate of about 7% was achieved, originating from a range of different stakeholders.

The COREALIS questionnaire was launched in July 2018 and answers were collected during July and August 2018. Due to a low rate of responses during the summer period, an updated version of the questionnaire was sent again to the ERTICO 1400 GDPR compliant contacts and to the extended list of port stakeholders in October 2018. This action increased the number of answers and provided a relative high number of responses for proper analysis of questionnaire results. This analysis provides clear conclusions and generates guidelines for the development of key elements of the various COREALIS innovations. In addition, several

[1] European Sea Ports Organisation, Trends in EU Ports Governance, 2016

telephone interviews were conducted with key stakeholders. These interviews provided complementary data and supported the preliminary conclusions.

The analysis highlighted the fact that businesswise the COREALIS innovations with the most impact as perceived by stakeholders are the Truck Appointment System and the Cargo Optimisation tool. Among the most critical elements for the uptake of innovative, integrated and sustainable solutions, visibility and interoperability of systems emerged in the Focus Groups. An increase of visibility of train and barge capacity and availability would already increment the quantity of cargo distributed over rail and inland waterways with immediate reduction of congestion in roads. A shift towards increased visibility and eventually interoperability of systems across transport modes would be possible through cooperation of different stakeholders and policy support to data sharing. The COREALIS innovations like the Port of the Future Serious Game will likely be useful tools to stimulate these discussions.

The insights acquired in the study will be the stepping stone for subsequent project tasks to effectively and efficiently focus their development and implementation work, allowing also the project to achieve the best early results with maximum efficiency.

1. Introduction

1.1 Purpose of the Document

The overall objective of the present deliverable is to list and classify the stakeholders that constitute the ecosystem of a smart port and its surrounding urban space, including but not limited to the following categories: **decision makers from the port authority, port operations and asset managers**, **port IT infrastructure managers**, **freight forwarders**, **shipping and trucking companies managers**, **rail operators**, **barges operators**, **truck drivers**, **city council members** and **regional authorities representatives**, **SMEs** and **industry CEOs/managers** active in the COREALIS port-cities.

Deliverable D1.2 is a comprehensive report on the identification and profiling of the smart port-city stakeholders in the COREALIS port-cities, their business/operational profile and the areas of intervention and interaction with the COREALIS framework.

In addition, D1.2 aims to assess the interest of the stakeholders in the several innovations that the COREALIS project will develop. These interests can vary over time. The final expectation is that the insights gathered can be used to give input to a deployment roadmap of the COREALIS innovations. This roadmap can maximise the efficiency of developments and efforts and result in an early Return On Investment (ROI).

The process adopted in the work for the development of this deliverable followed a five-staged approach:

1) Creating and issuing the questionnaire to stakeholders to find out their interests.
2) Analysing the data received.
3) Conducting telephone interviews with the most interesting respondents.
4) Establishing stakeholder classification.
5) Phrasing the conclusions.

1.2 Intended readership

The work presented in this report addresses the needs of three potential user communities:

- **Container Terminal (CT) operators** who are interested in improving the port operational efficiency and embracing circular economy models in its port strategy and operations
- **Public Authorities (local, regional or national)** who are interested in enabling the port to take informed medium-term and long-term strategic decisions and become an innovation hub of the local urban space. In addition, public authorities are interested to reduce the port's total environmental footprint associated with intermodal

connections and the surrounding urban environment for three major transport modes, road/truck, rail and inland waterways.

- **Local communities** who are interested in lowering the environmental impact of port operations in the surrounding urban space. Local communities would like to have an updated view of ways to create efficient connections with hinterland transport network.

It may seem difficult to address the needs of such diverse communities in a single document. Nevertheless, the editors believe that the workflow allows the organization of the information in ways useful to all aforementioned communities.

1.3 Relation with other COREALIS deliverables

This document will feed several other key deliverables of the project and WP1 "Port of the Future Needs and Requirements". The current document is in close relation to Task 1.1 "Identifying the Port of the future challenges, enablers and barriers" as well as task 1.3 "Building the COREALIS User Stories and Scenarios".

While the project Task 1.1 focuses more on the "internal" aspects of the terminal operations, this deliverable focuses on the "external" relations with the stakeholder community.

There is also a relation with the Task 1.3 on the "*COREALIS User Stories and Scenarios*" of WP1. In this task, the COREALIS user stories and high-level scenarios to be implemented will form part of the Living Labs (LLs) of WP5. The user stories will be inspired by the set of the COREALIS Personas of T1.2.

All the aforementioned tasks give complementing inputs to the Task 1.4 "Port of the future needs and requirements" which will collect needs and requirements, based on the scenarios derived in T1.3. The task will cover not only technical requirements (functional and non-functional) from the ports' side, but will also seek to identify legal/regulatory, security and data privacy needs for the proper implementation as well as scale-up of the scenario described by the stakeholders.

Finally, the results in this document will feed WP2. WP2 focuses on the scope of port-hinterland connections and aims to minimise the negative impacts associated to transport flows between the ports and the inland origin and destination of goods.

The complete project structure and the relationship of this deliverable within the whole project are better illustrated by the figure below taken from the DoA.

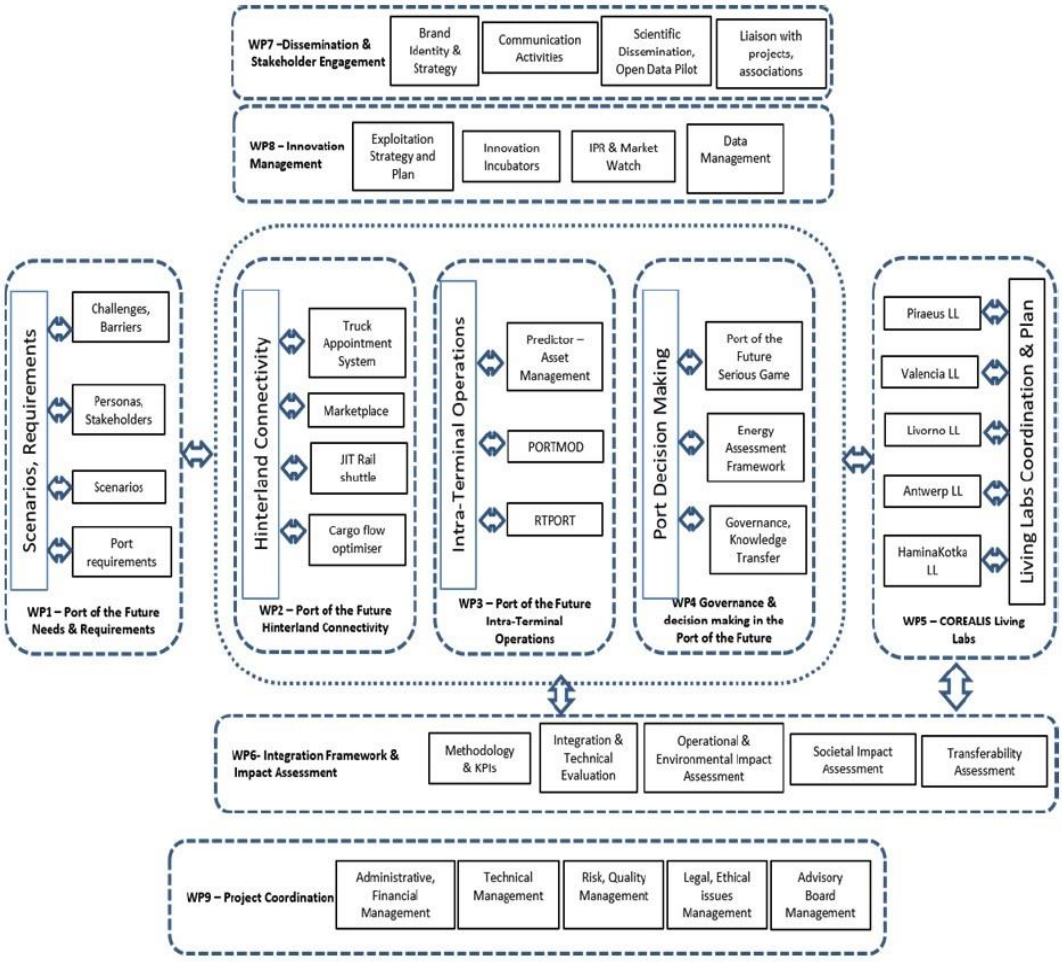


Figure 1 COREALIS Project Structure

2. Methodology

2.1Methodology Scope and Structure

This section contains a description of methods, techniques and tools used in the framework of Task 1.2 for the identification of the smart port-city stakeholders and COREALIS Personas. These are summarised as follows:

- Questionnaires and semi-structured interviews for the identification of smart port-city stakeholders and COREALIS Personas (Tier I, II and III)
- Focus Groups (Greenbaum, 1997)/workshops

This two-step process aims to reach conclusions, by determining cause-effect relationship and by structuring problems and challenges according to their levels of complexity and specificity. The analysis aims to, produce and classify a comprehensive list of the port of the future stakeholders. This approach has a significant impact because it is structured based on participatory techniques.

2.2 Questionnaires/semi-structured interviews for identification of stakeholders and COREALIS Personas

The steps followed to create the list of stakeholders, distribute the questionnaires and extract their viewpoints and expertise is described below:

Step 1: A list of '**tier-I' stakeholders** – namely people, groups and bodies who will be able to describe the institutions (including formal and informal organizations and systems) involved and influencing the smart port-city ecosystem - is compiled. .

The process includes keeping details of these 'tier-I' stakeholders, including what category they fall into, i.e. Public authorities, Container Terminal Operators, ICT service/content providers, SMEs, etc. They have been established as key for the smart port-city ecosystem. This process includes keeping personal data of participants e.g. Name, Surname, Work Position, e-mail, always in accordance to COREALIS D10.1 principles.

The output of this step is the List and profile of tier-I stakeholders.

Step 2: By means of an online survey as well as a series of semi-structured and unstructured interviews with these 'tier I' stakeholders, the '**tier II' stakeholder list** is identified, namely an extended and comprehensive list of people and organizations involved and influencing the smart port-city ecosystem. By mapping and prioritizing the stakeholder list, this is revised and extended to a final set of stakeholders around which the scenarios describing the implementation of the project innovations in the Living Labs will be created.

The output of this step is the List and profile of tier-III stakeholders.

2.3 Establishing the SurveyMonkey questionnaire

The questionnaire developed in the framework of this deliverable aimed at gathering information related to the different stakeholders' operations in ports as well as their perspectives and expectations in relation to COREALIS innovations.

The questionnaire developed was published on-line with the use of the SurveyMonkey platform: https://www.surveymonkey.com/r/KJ32YY7

2.4 Analysing the data received

Following the collection of data and information, a thorough analysis was performed by ERTICO. This was based upon the original data received via SurveyMonkey and its specific visualization tools, but also by creating more advanced charts, which translated the data into a more comprehensive format. This allowed us to build a better graphical representation of the outcomes and provided us with better options for obtaining clear insights on each result. The analysis allowed us to detect interesting correlations between data and based on them, we were able to derive clear conclusions and guidance for the subsequent COREALIS work packages.

2.5 Performing interviews

A list of key parties to contact for telephone interviews was created based on the received responses. The main motivation for performing the interviews was that more detailed information for developing our results could be gained from these stakeholders.

2.6 Phrasing the stakeholder classification

Following the analysis, a stakeholder classification was established. For each stakeholder classification, a deployment roadmap of the COREALIS innovations is described.

3. Building the questionnaire survey

3.1Involved stakeholders

An initial list of stakeholders that needed to be addressed by the questionnaire, was presented in the Kick-off Meeting (KoM) session, Athens dd. 7/5/2018 related to this task. In this session, the list was completed and prioritised. The result is presented below:

Priority stakeholders identified during the meeting in Athens

- Public administrations (ministries, traffic management authorities and urban planners, customs and coast guard authorities (added during the meeting)).
- Shipping and trucking company managers

Added during the meeting

- Freight operators
- Nautical service operators

Obvious contacts (Identified as such during the meeting)

- Rail operators
- Barges operators
- Port user communities

Nice to have (but not necessary) identified as such during the meeting in Athens

- Cities

Other

- Truck drivers
- ICT service / content providers

The SurveyMonkey questionnaire was addressed to the aforementioned stakeholders.

3.2 Questionnaire structure

3.2.1 Aim of the questionnaire

The aim of the questionnaire was to list and classify the stakeholders that constitute the ecosystem of a smart port and its surrounding urban space.

The questions aimed to reveal insights from the port-city stakeholders (external to the port), on their expectations and predictions regarding the COREALIS innovations and their potential

impact on their areas of interest. Responses were gathered in the form of data sets that could be processed into a conclusive report to formulate 'priorities' and define an implementation roadmap for the PoF innovations.

3.2.2 Building the questionnaire

The structure of the questionnaire was based on the assumption that stakeholders would have a good understanding of how COREALIS innovations could be of benefit to them and how they could impact their future business. We expected the responses to give a good insight into the stakeholders' expectations. The questionnaire, divided in two parts, was designed so that stakeholders could fill it in in 15-20 minutes.

The first part contains questions that can be answered in a short time, based on the natural intuition of the respondent, through responding to multiple-choice questions. At the end of this first part, the respondents are asked if they would like to provide further information in an optional second part. The second part contains a few questions intended to collect deeper insights and more detailed information. Each stakeholder can respond by writing free text responses to each question. These questions are also taken as a reference input for the interviews (see further below).

In addition, since a lot of stakeholders are involved in both internal and external operations with the port, a significant risk related to the fact that a stakeholder may be confronted with the COREALIS survey twice, even containing the same or similar questions: once for Task 1.1 and then again for this deliverable, was identified. To tackle issue, it was decided (together with the project coordinator and the T1.1 task leader) to merge each deliverable's questionnaire into a single one.

A) Part 1 of the questionnaire

Questionnaire sections

The first section of the questionnaire, titled *'About you'*, aims to identify participants and to ensure the information collected from them can be used in a legal and transparent way according to the new GDPR rules [1].

The second section, *'About your organisation'*, aims to identity the company profile and the role it has in the value chain of the port's business activity.

The third section gathers information on the role the company has. It asks for the kind of contract the company has with the port and what type of services and products it delivers to or receives from the port.

The subsequent questions are gathered in sections, addressing each one of the major potential COREALIS innovation impact areas. A reference to these impact areas included in the final project proposal was submitted.

3.2.3 Section on applied policies

Each stakeholder is asked to identify the most important policies that they follow in their daily business operations.

Question: *"Indicate the importance of the following policies for your organisation's business (1=lowest, 5=highest importance)":*

- Environmental policies
- Transport policies
- Port city policies
- Port policies
- R&D policies
- Spatial policies

A further explanation of the policies is found in Annex 2 of this document.

3.2.4 Section on applied KPIs

The questionnaire aims to detect which KPIs are important to the business of each stakeholder and if the level of importance will change over time, as it can be expected when COREALIS innovations will be introduced and new services and products will be established.

KPIs themselves are grouped into the following interest sections. Each stakeholder is asked to indicate which applied KPI is the most important in each section.

- **KPIs related to climate change**:

Question: *"Below you will find KPIs that the project considers important in regards to Climate Change. Please indicate if your organisation is currently measuring these KPIs in its port operations."*

- KPI related to CO_2 emissions
- Noise related KPI
- KPI evaluating the modal transport split
- KPI evaluating the introduction or use of smart grid and/or green energy technologies and services
- KPI evaluating the introduction or use of sustainable energy resources

- **KPIs related to operational and infrastructural cost:**

Question: *"Below you will find KPIs that the project considers important in regards to operational and infrastructural costs. Please indicate if your organisation is currently measuring these KPIs in its port operations."*

- Reduction in the number of empty container runs
- Better use of the yard due to improved stacking of containers
- Reduction of false-positives/negatives in regards to replacement/renewal decisions for assets.
- Reduction of operational and maintenance costs of the port spare parts, including tyres.
- Reduction in the trucks and yard equipment idling for more than one shift.

➢ **KPIs related to the logistics efficiency**

Question: *"Below you will find KPIs that the project considers important in regards to logistics efficiency. Please indicate if your organisation is currently measuring these KPIs in its port operations."*

- Reduction of the time a container stays in the port prior to being handed over to another transport mode
- Lower unit cost in the end-to-end supply chain due to a better estimated time of arrival
- Improvement of modal split to rail
- Improvement of modal split to inland waterways

3.2.5 Some other Specific questions

- **Waiting time at the gate**
  This question is especially related to the port itself. The waiting time for trucks at the gate of the port is one of the most important elements regarding the efficiency of port operations. It impacts the port's operations, the traffic, the number of hours worked by the truck driver etc.

- **Asset management capabilities applied in the port**
  This is a free text field that the port stakeholders can fill in to provide further insights.

3.2.6 Expected impact of the COREALIS innovations

The questions in this section were designed to draw insights from the stakeholders as to how they think the various COREALIS innovations can impact their operations.

3.2.6.1 Related to the stakeholder's business

- Expected impact on personnel and Revenue

Each stakeholder is asked to indicate their expectation of the relative impact (ranking: 5%, 10%, 25 %, < 50% or >50% impact on the related personnel and revenue).

3.2.6.2 Expected impact on the KPIs that the stakeholder applies

When innovations are deployed and in operation, do they have an impact on the KPIs? The stakeholder is asked to indicate the expected impact on each KPI.

Question: *"Indicate which innovations you expect to have the greatest impact on the KPIs listed below for your organisation"*.

For each KPI the stakeholder has to indicate the importance of the impact of each of the COREALIS innovations. The aim was to find out if there was a correlation between the KPIs measured (previous question) and the importance of the potential impact of the innovations.

3.2.6.3 Their expected impact on the barriers

Stakeholders are confronted with barriers (or roadblocks) to operate or grow their business. COREALIS innovations might lower or reduce those barriers, paving the way for business expansion.

The barriers were taken as a reference from the initial project proposal.

There are three identified barriers:

- *Technical barriers*
- *Legal and policy barriers*
- *Economic and business barriers*

Question: *"Indicate which innovations are best suited to address the following barriers for your organisation"*.

3.2.6.4 Expected impact on the policies

Stakeholders are now requested to indicate their expectations for the impact of the COREALIS innovations on the applied policies. The aim is to find out whether a correlation between the KPIs measured (previous question) and the importance of the impact of the innovation exists.

Question: *"For each policy, indicate which PoF innovation will have the greatest impact for your organisation applied policies"*.

3.2.7 Identification of Enablers, Barriers and Challenges

The following questions were asked in order to gauge the stakeholder's opinion of enabling factors, barriers and challenges. These questions were merged from T1.1 in the project.

1. *Question on the enabling elements for the operation and business of the port*
   - Hinterland connectivity
   - Automation
   - Scalability of operations
   - Traceability of operations

- Freight consolidation

Question: *"Which of the following do you consider as the most important enablers for the Port of the Future" (*1 - Unimportant, 5 - Most Important).

2. *Question on the barriers for the operation and business of the port*

The following barriers were listed:

- Legislation
- Societal acceptance
- Technology limitation
- Environmental footprint

Question: *"Which of the following do you consider as the most important barriers for the Port of the Future"* (1 - Unimportant, 5 – Most Important).

3. *Question on the important challenges for the operation and business of the port*

The following challenges were listed:

- Operational capacity
- Safety and security
- Operational efficiency
- Service digitalisation
- Sustainable growth

Question: *"Which of the following challenges do you consider as the most important Challenges for the Port of the Future"* (1 - Unimportant, 5 - Most Important)

For further explanation of these observed business enablers, barriers and challenges as well as the analysis of the response, the reader is referred to Deliverable D1.1.

3.2.8 Additional requested information

B) Part 2 of the Questionnaire

The second part of the questionnaire was only visible if the stakeholder indicated that they wanted to give more information. Most of the answers were expected to be free text inputs.

The following questions were raised:

1. **Question**: *"Describe the products/services that your organisation offers"*
2. **Question:** *"Describe your place in the value chain of the ports business"*
3. **Question:** *"Describe the cost structure of your operation with the port"*
4. **Question:** *"What incentives do you provide to the port?"*
5. **Question:** *"What incentives do you get from the port?"*

6. **Question**: *"Describe the ICT tools/platforms that your organisation uses"*
7. **Question:** *"Describe the opportunities for your organisation to incorporate the PoF innovations"* for each of the COREALIS innovations

3.3 GDPR compliancy

In light of the entry into force of the General Data Protection Regulation (GDPR) [1] earlier this year (25 May, 2018), necessary steps were taken into consideration to ensure that survey participants' personal data are protected, the procedure of using their data is clearly communicated and participants are aware of their rights before starting the survey. This was achieved by including specific GDPR related questions at the beginning of the survey, supported by a specific GDPR background information document. If participants did not agree with the questions put forward at this stage, then the questionnaire was designed to end.

Annex 5 contains the entire document included in the survey to support the GDPR requirements along with the questions provided to participants at the beginning of the survey.

3.4 Dissemination channels

This survey was sent to more than **1400 GDPR** compliant contacts via email using the MailChimp platform [2]. The mailing list was comprised of ERTICO network contacts that had opted in to receive information on transport and logistics projects such as COREALIS. The contacts consisted of people, institutions, authorities and industries involved in the smart port-city ecosystem.

Since there was no established contact list of the stakeholders involved in the five Living Labs of COREALIS (Port of Piraeus, Port of Livorno, Port of Valencia, Port of Hamina Kotka, and Port of Antwerp), a supporting survey was established and sent to the related Living Lab Leaders. They distributed the list to their known stakeholders. All of these registered stakeholders received the questionnaire as well.

It was noted that a number of questions in the survey would be the same as the questions raised in a survey needed in T1.1. of the COREALIS project Port of the Future challenges, enablers and barriers. Also a number of stakeholders are operating both in the port and externally to the port. Therefore, in order to avoid that a stakeholder would be sent a survey twice, it was agreed between task leaders (ERTICO, PCT) and the Project Coordinator (ICCS) that task 1.1 specific questions would be integrated into the survey of T1.2.

ERTICO's newsletter channel was also included on 18/7/2018 and 11/10/2018 as an attempt to enlarge the response hit rate. The newsletter has more than 2400 subscribers.

The questionnaire was also communicated constantly using the social media platforms Twitter and LinkedIn by the COREALIS project partners. The Twitter account currently maintains almost 200 followers while the LinkedIn page maintains almost 100 followers.

3.5 Response rates

In July 2018 there were in total 37 individual responses to the online questionnaire, while 4 telephone interviews were successfully carried out. The participants included:

- 15 ICT Service Providers
- 6 from the Port User Community
- 2 from Public Involved Ministries
- 2 from Urban Infrastructure Planning organisations
- 1 from the City Council
- 1 from Urban Traffic Management
- 1 Freight Operator
- 1 Barge Operator

It should be noted that some participants did not indicate which stakeholder group they represent. Therefore, there is a disparity between the numbers listed above (29 in total) and the 37 individual responses we received. As can be seen above, highest number of stakeholders was the ICT Service Providers. Based on the telephone interviews as well, it was clear that these stakeholders providing ICT services aimed at improving the efficiency of the port through better management of loading times as well as truck appointing systems.

Once the questionnaire has been sent another time in October 2018, there were 70 additional respondents reaching a total of 107 responses, enriching the survey with more precise answers. Out of 107 there were answers skipped and some cleaning of the data needed to be done. This response rate (94/1346 or about) 7% can be regarded as a normal 'response' [2] rate in on-line surveys.

The survey also resulted in a more equal presence of stakeholder sectors (see 4.1.1).

[2] Journal report " The Complete Guide to Acceptable Survey Response Rates by Adam Ramshaw

4 Questionnaire response analysis

4.1Stakeholder analysis and classification

4.1.1 Sectors involved

Stakeholder respondents came from Public, Transport, ICT and Other sector (including Research, Consultancy and Specialised Companies), as shown in the following figure:

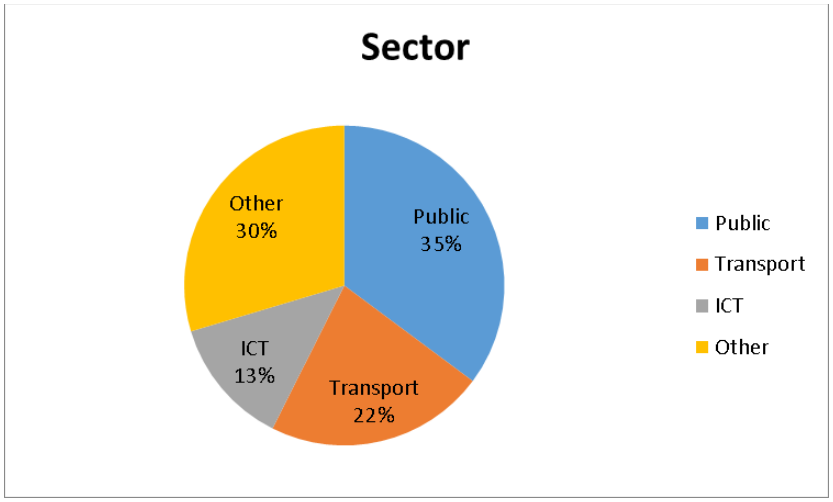


Figure 2 Stakeholder Sectors

❖ The **public sector** respondents represented 35% of the overall respondents including the following stakeholders, which have been highlighted also in first version of the Deliverable D1.2.

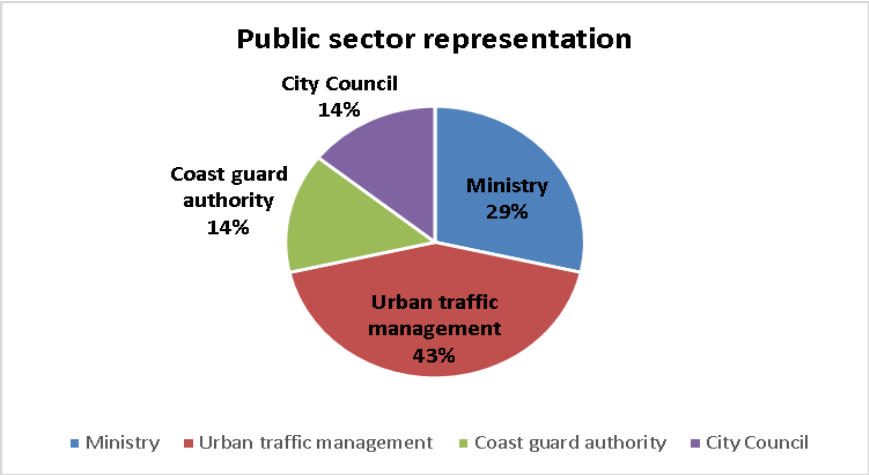


Figure 3 Public Sector representation

- **Ministry:** governmental organisation, headed by a minister managing a specific sector of public administration.
- **Urban traffic management:** authorities and companies specialising in the development of a more open approach to Intelligent Transport Systems or ITS in urban areas. A more efficient use of existing roadway capacities, harmonised traffic flows, emission-related traffic control, prioritisation of public transport means and the focus on pedestrian safety.
- **Coast guard authority:** broad legal authorities associated with maritime transportation, hazardous materials shipping, bridge administration, oil spill response, pilotage, and vessel construction and operation (Military Service, Vessel Boarding, Navigation Safety, Naval Safety and Security, Waterway Security, Assistance, Pollution Response, Vessel Inspections, Customs, Maritime Security, Transportation, etc.).
- **City Council:** the legislative body that governs a city, town, municipality, or local government area.

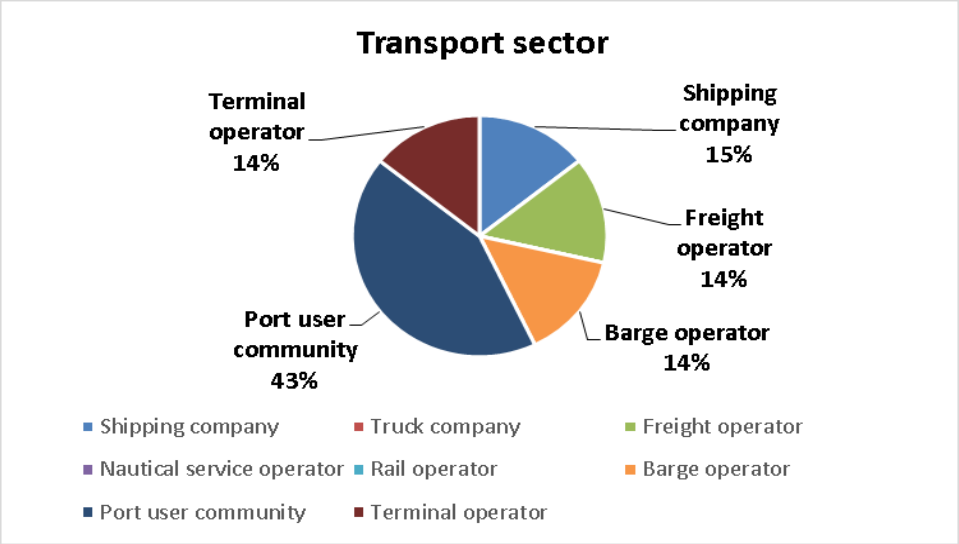


Figure 4 Transport Sector representation

❖ The **Transport sector** respondents represented 22% of the overall respondents, including the following stakeholders highlighted also in the previous version of Deliverable D1.2:

- **Shipping company:** a company whose business is in transporting goods or passengers in ships.
- **Truck Company:** a company that transports goods by lorry.
- **Freight operator:** company that specialise in the moving or forwarding of freight or cargo from one place to another.
- **Nautical service operator:** have a thorough knowledge of the port and can navigate all vessels safely and efficiently through the port in all conditions 24/7.
- **Rail operator:** have a thorough knowledge of the rail sector and can schedule trains movements safely and efficiently through the rail network and infrastructure in all conditions 24/7.
- **Barge operator:** organisations operating flat-bottomed ships, built mainly for river and canal transport of heavy goods.
- **Port user community:** users of an electronic platform that connects the multiple systems operated by a variety of organisations that make up a seaport user community. It is shared in the sense that it is set up, organised and used by firms in the same sector – in this case, a port community.
- **Terminal operator:** is a company that manages a facility in a port: e.g. container terminals: It is a facility where cargo containers are transhipped between different transport vehicles, for onward transportation.
- **Truck drivers**

❖ The **ICT service providers**: represented 13% of the overall respondents.

❖ Finally, 30% of respondents represented **other sectors** including **Research**, **Consultancy** and **Specialised Companies**.

4.1.2 Ports mentioned

Respondents were dealing with a number of ports that are within the COREALIS project and also outside the project as shown in the figure below.

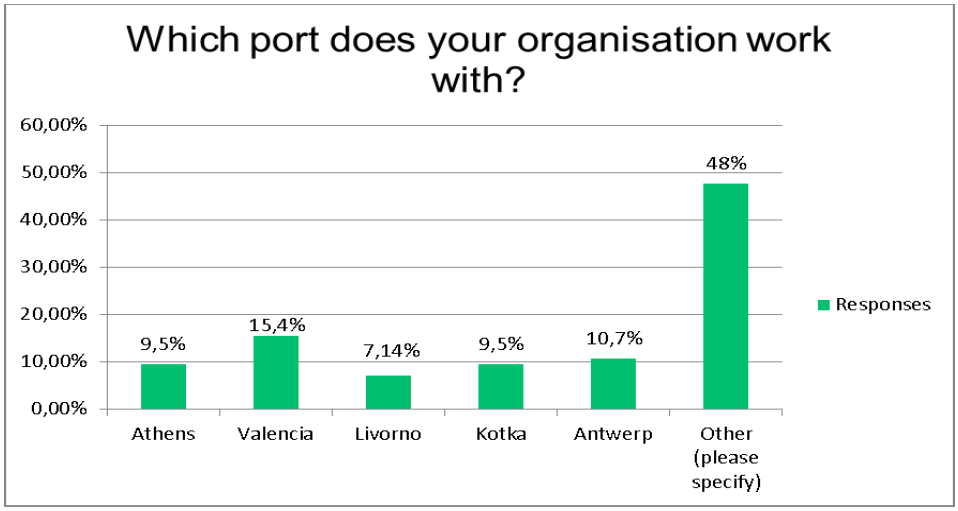


Figure 5 Ports that respondents work with

Apart from the Valencia, Antwerp, Athens, Kotka and Livorno ports, the majority of the respondents are in close interaction with other ports including **Trieste, Tenerife, Lisbon, Pasajes, Leixoes, London, Budapest, Linz, Passau, Hamburg, Estonia, Barcelona, Taragona and Helsinki.**

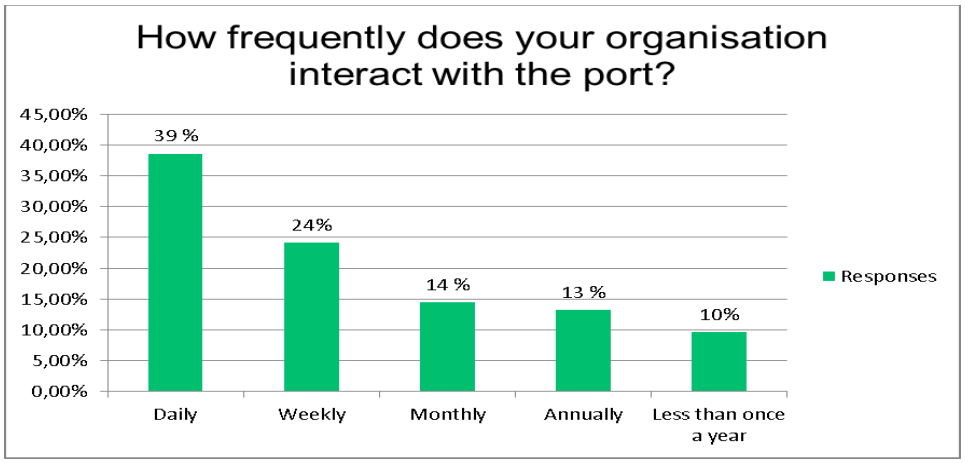


Figure 6 Frequency of organisations interaction with ports

Figure 6 shows how frequently the respondents interact with the port. More than 60% of all respondents have at least once a month an interaction with the port. The conclusion is that the respondents have a relevant knowledge on the ports operations based upon their communications with the port. The following figure shows that respondents are coming both from SME's and large organisations.

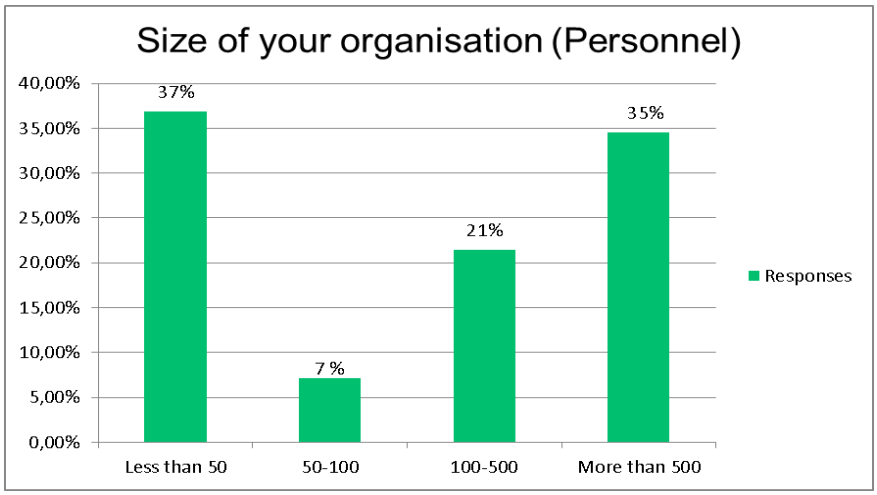


Figure 7 Size of respondent's organisation

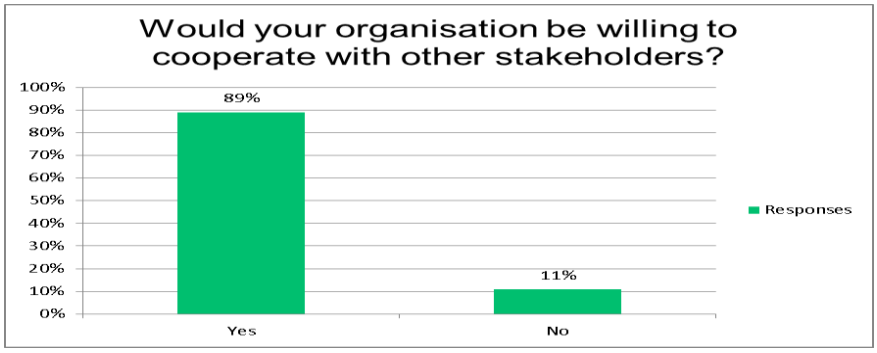


Figure 8 Respondent's willingness to cooperate with other stakeholders

Finally, 89% of respondents have expressed willingness to cooperate with other stakeholders, showing that communication is very important between various stakeholders and COREALIS project can facilitate this.

4.1.3 Policies applied analysis

For each policy, the respondents gave a score on how important a certain policy is in relation to their business operations. A weighted sum of scores and respondents for each policy indicates the importance of this KPI (Table 2). The ranking was based on 1 to 5 scale: (1: less important, 5: highly important).

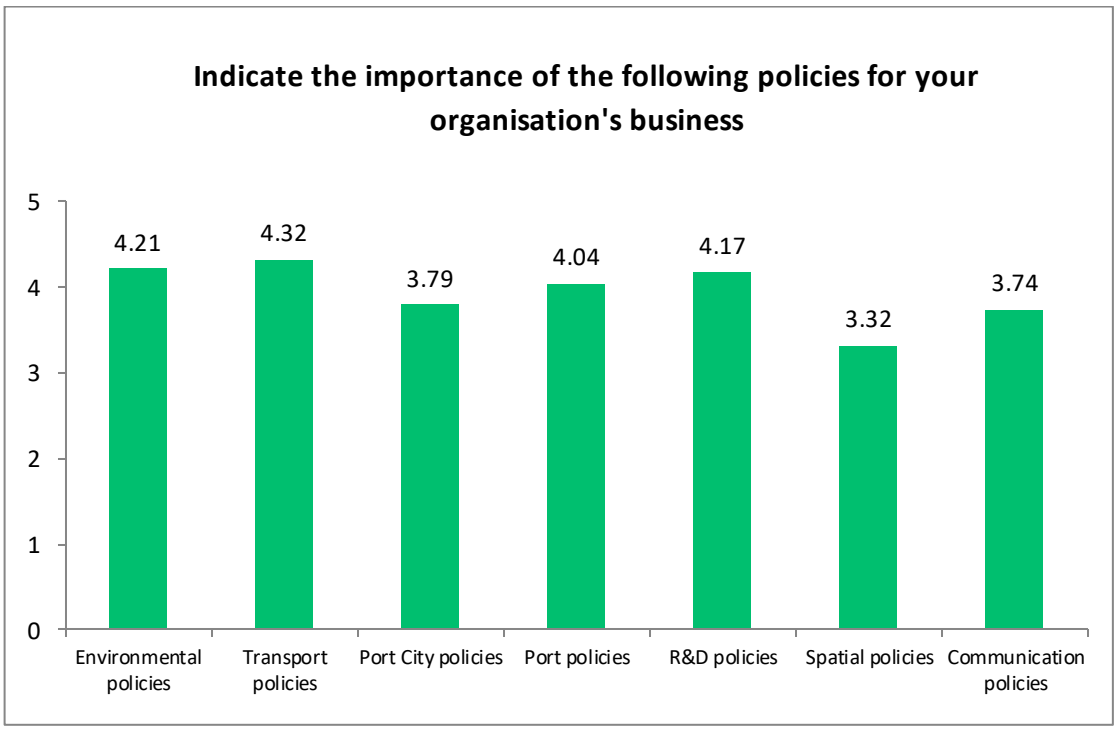


Figure 9 Importance of policies for organisation's business

This graph shows that there is almost no distinction in the importance of the various policies. This shows that the portfolio of stakeholders has different interests and perspectives which is good from a consultation point of view.

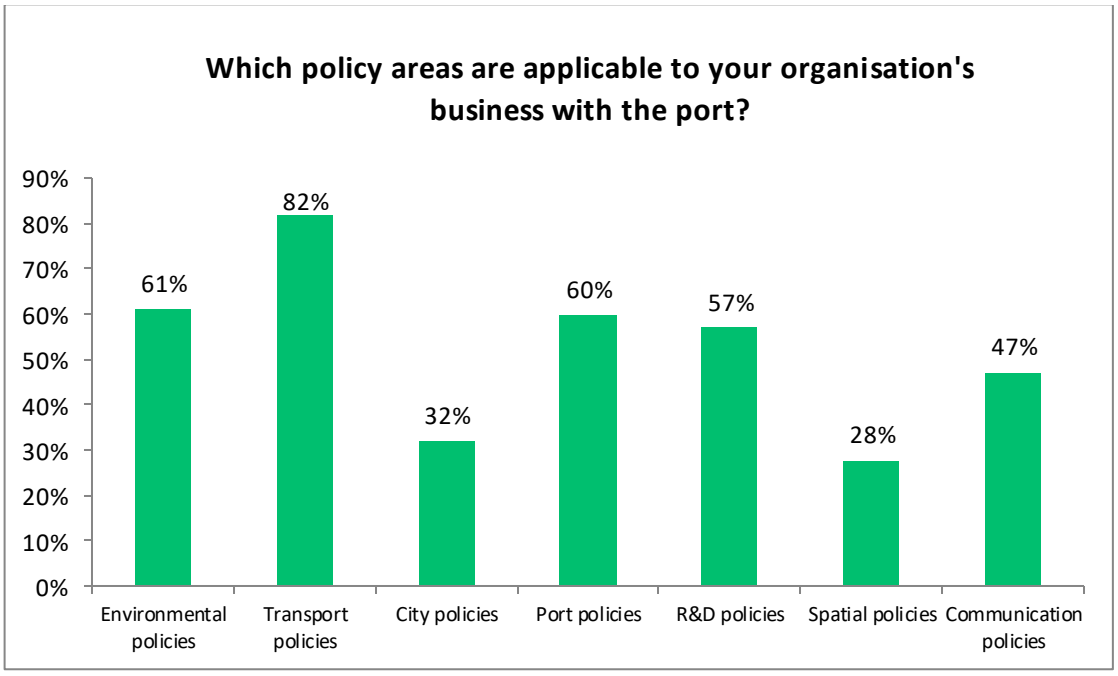


Figure 10 Applicable policy areas for respondent's business

With reference to Figure 10, some potential conclusions can be made of this analysis:

- Involved stakeholders might have the opinion that ports can grow in space without major policies. Another option can be that space gets less important for a port if it becomes possible to improve the yard's space by a better stacking of containers and by having less trucks on the yard (see next paragraph on KPIs).
- Environmental and R&D policies are perceived to play a significant role for the organisations' business with the port.
- Stakeholders consider that transport policies are the most applicable in their organisation's business with the port.

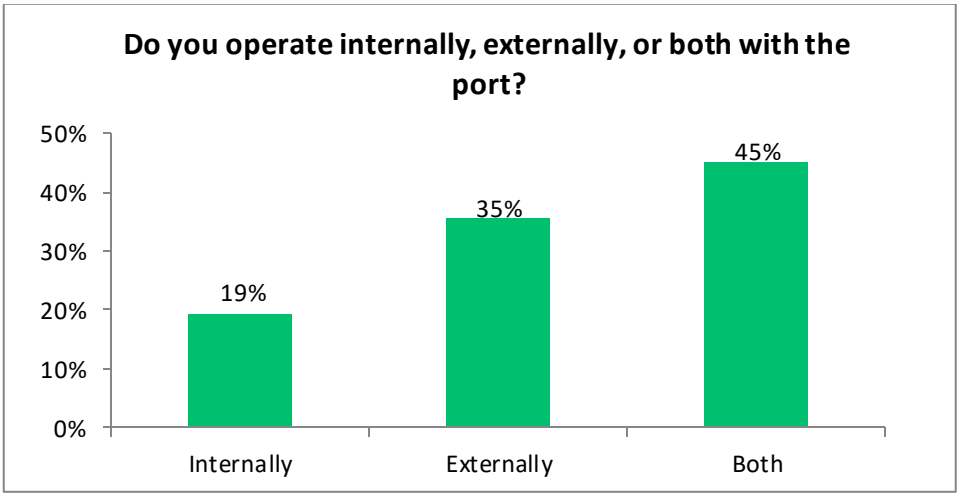


Figure 11 Internal and external cooperation with the port

Figure 11 shows that most of stakeholders operate both internally and externally with the port.

4.1.4 KPIs applied analysis

In this section we analyse the relevance of evaluating several KPI categories, as perceived by the survey respondents.

4.1.4.1 Importance of KPIs related to climate change

Figures 12 and 13 illustrates the relevance of climate related KPIs based on the amount of respondents (in % of total of respondents) for a given year.

The Modal Transport Split will be the most dominant KPI used to evaluate the impact on climate change followed by CO_2 and sustainable energy resources KPIs.

Stakeholders consider that the need for the evaluation of climate-related KPIs will considerably increase overall until 2022. Nevertheless, after 2022 the importance of evaluating these KPIs might decrease, probably considering that several measures will be in place by then.

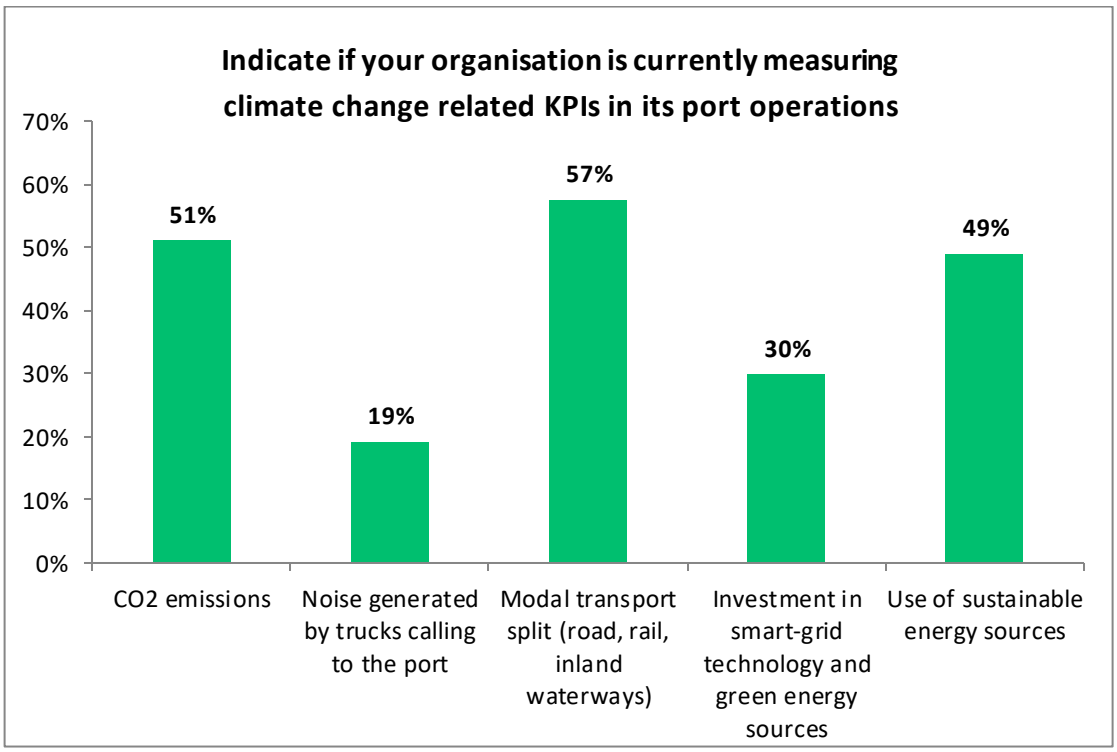


Figure 12 Observed relevance of climate change related KPIs over time (2018)

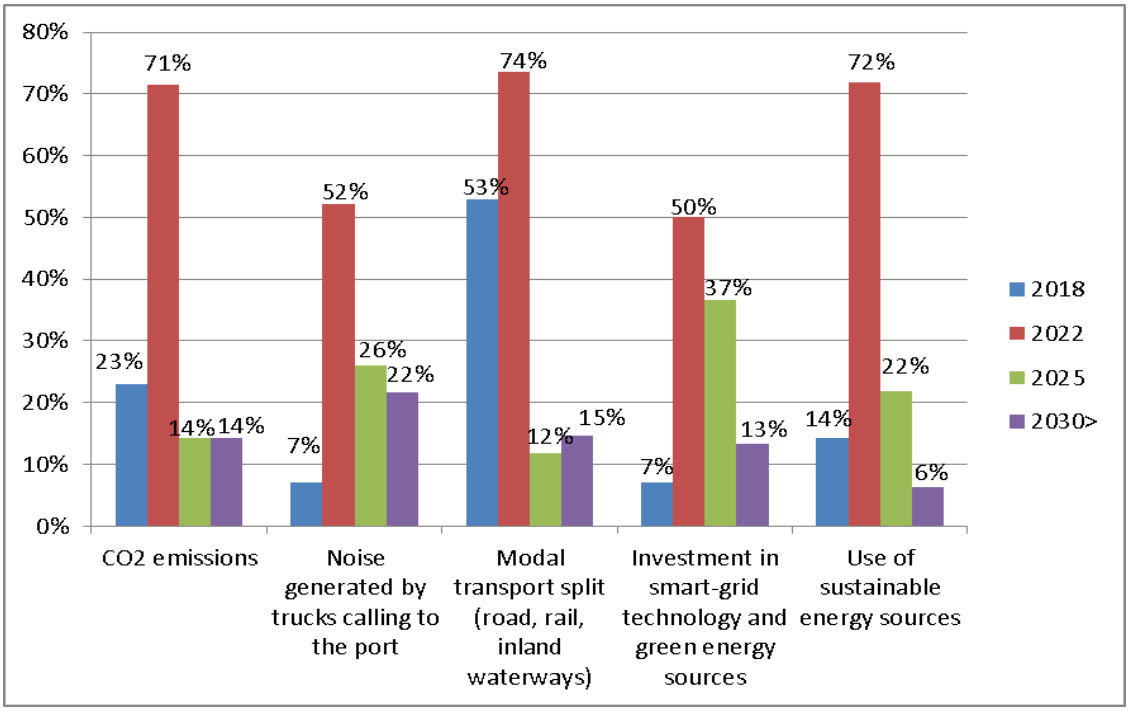


Figure 13 Observed relevance of climate change related KPIs over time (2022-2030)

4.1.4.2 Importance of KPIs related to infrastructural cost

Figure 14 shows the relevance of infrastructure cost related KPIs based on the amount of respondents (in % of total of respondents) . The following abbreviations were used:

- *KPI: Reduction in the number of empty container runs (Container runs)*
- *KPI: Better use of the yard due to improved stacking (Stacking)*
- *KPI: Reduction of false-positives/negatives in regards to replacement/renewal decisions for assets (Assets)*
- *KPI: Reduction of operational and maintenance costs of the port spare parts, including tyres (Spare parts)*
- *KPI: Reduction in the trucks and yard equipment idling for more than one shift (Equipment)*

Currently, the most relevant KPIs are the Container runs KPI and Equipment KPI. These are considered very important operational KPIs for now and the near future.

In the near future, the need for the evaluation of all infrastructural cost related KPIs will increase. In particular, the relevance of the KPI related to *Container runs* will significantly increase 83%. Internal efficiency of operations will also be measured in terms of use of the port's yard towards the improvement in stacking of containers.

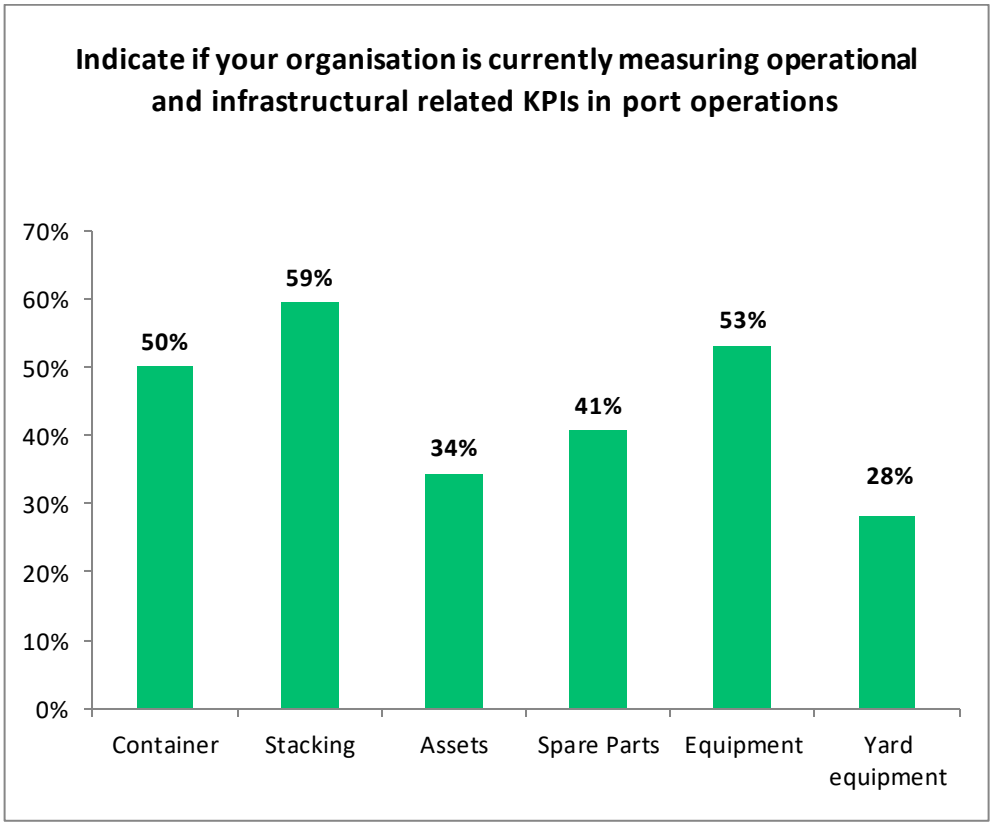


Figure 14 Observed relevance of Operational and Infrastructural costs related KPIs (2018)

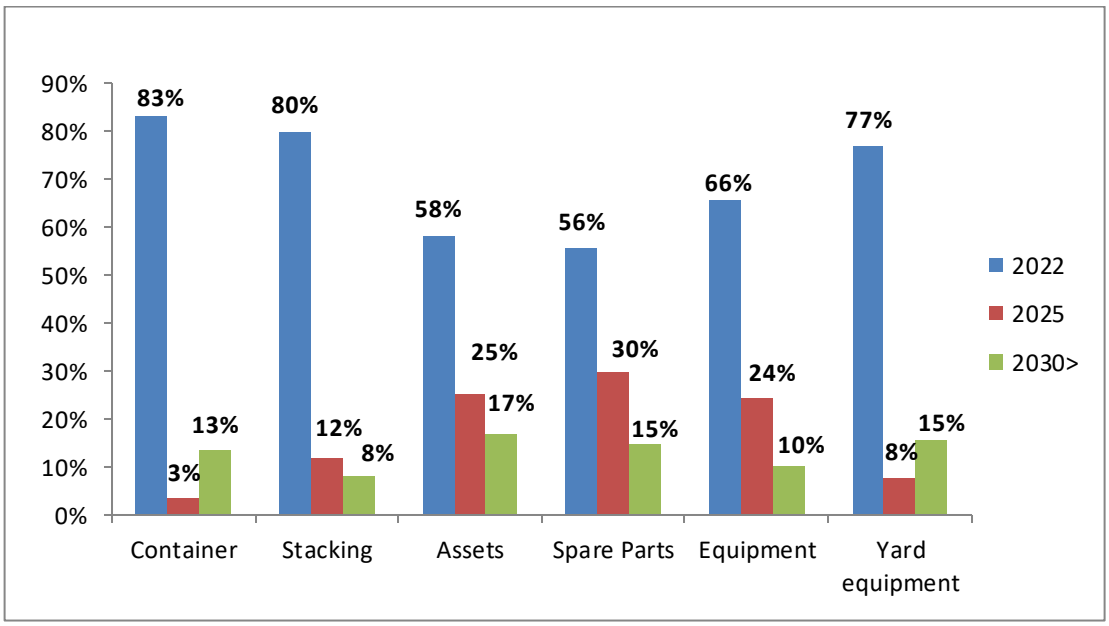


Figure 15 Observed relevance of Transport related KPIs over time (2022-2030)

4.1.4.3 Importance of KPIs related to logistics efficiency

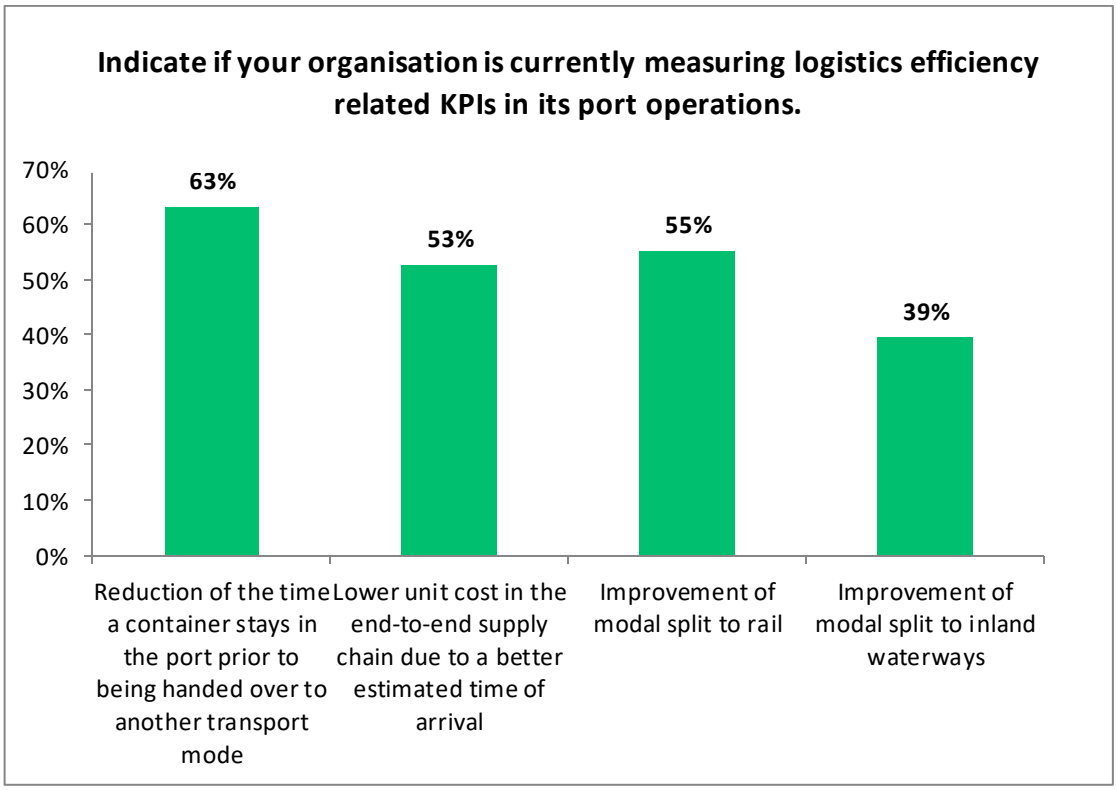


Figure 16 Observed relevance of logistics efficiency KPIs

Stakeholders were asked to indicate if their organization is currently (2018) measuring Logistics Efficiency related KPIs.

- 63% of respondents answered positively for the KPI on the *Reduction of the time a container stays in the port prior to being handed over to another transport mode*.
- 55% of respondents answered positively for the KPI on the *Improvement of modal split to rail*.
- 53% of respondents answered positively for the KPI on the *Lower unit cost in the end-to end supply chain due to a better estimated time of arrival*.
- 39% answered positively for the KPI on the *Improvement of modal split to inland waterways*.

The following figure shows the observed relevance of logistics efficiency KPIs over time (2022-2030).

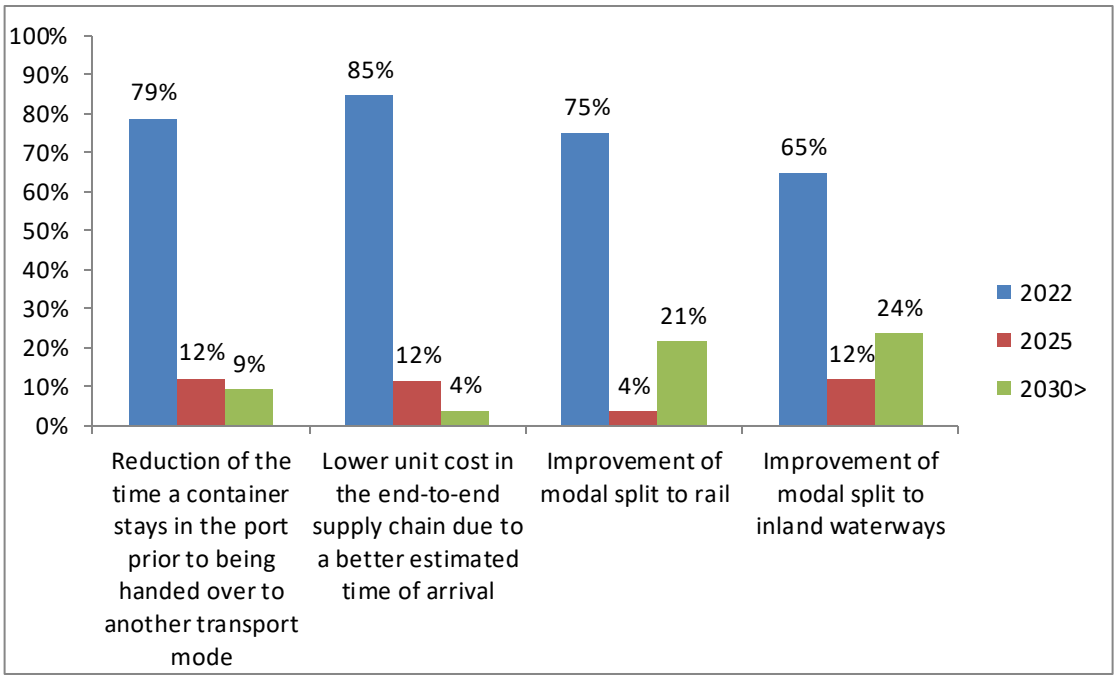


Figure 17 Observed relevance of logistics efficiency related KPIs over time (2018)

The importance of evaluating these KPIs will grow in the near future through to 2022. Respondents show an optimistic view by saying that this KPIs will diminish in the longer term (2025 and 2030). It is likely that stakeholders consider that logistics efficiency will be optimised through deployment of innovative solutions.

4.1.5 Analysis on perceived enablers, barriers and challenges

For a comprehensive analysis on enablers, barriers and challenges of European ports, the reader is referred to the COREALIS Deliverable D1.1 on the "*Port of the future challenges, enablers and barriers*"[3].

[3] COREALIS Deliverable, D1.1: Port of the future challenges, enablers and barriers (2018)

4.2 Generic analysis on the interest for the COREALIS innovations

This section discusses the generic analysis of the impact of the COREALIS innovations on the businesses, policies, KPIs and barriers in the port related operations of the stakeholders.

4.2.1 Business impact

Business impact is measured by analysing the responses on expected impact on personneland revenue, both related to the port's operations. The respondents indicated the % impact (highlighted in different colours) on the personnel and revenue that they expected of each of the innovations. Responsesreceived areillustrated inthe figures below, where the importance is stressed on the highest rate:

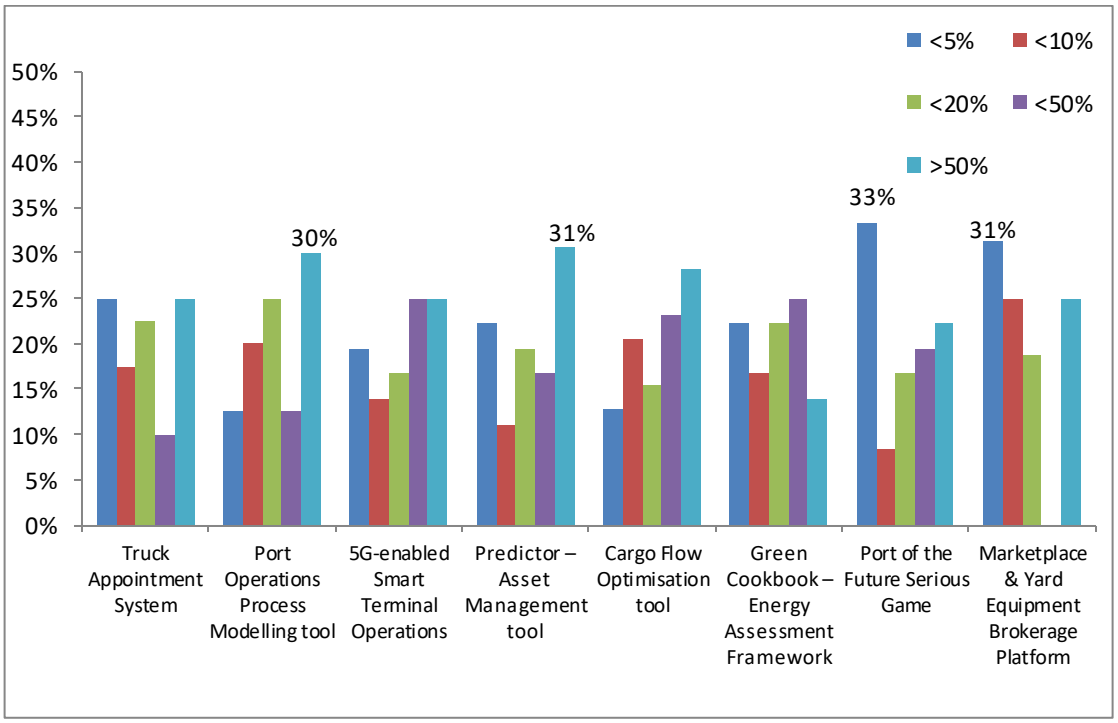


Figure 18 Expected business impact on personnel and revenue for port operations

Figure 18 reveals that more than 30% of the stakeholders surveyed, have selected the Port Operations Process Modelling tool (PORTMOD tool) and the Predictor-Asset Management tool as the innovations that will have more than 50% impact on their business. In addition, approximately 30% of the respondents think that the Port of the Future Serious Game and the Marketplace and chassis brokerage platform will impact less than 5% personnel and revenue on port operations.

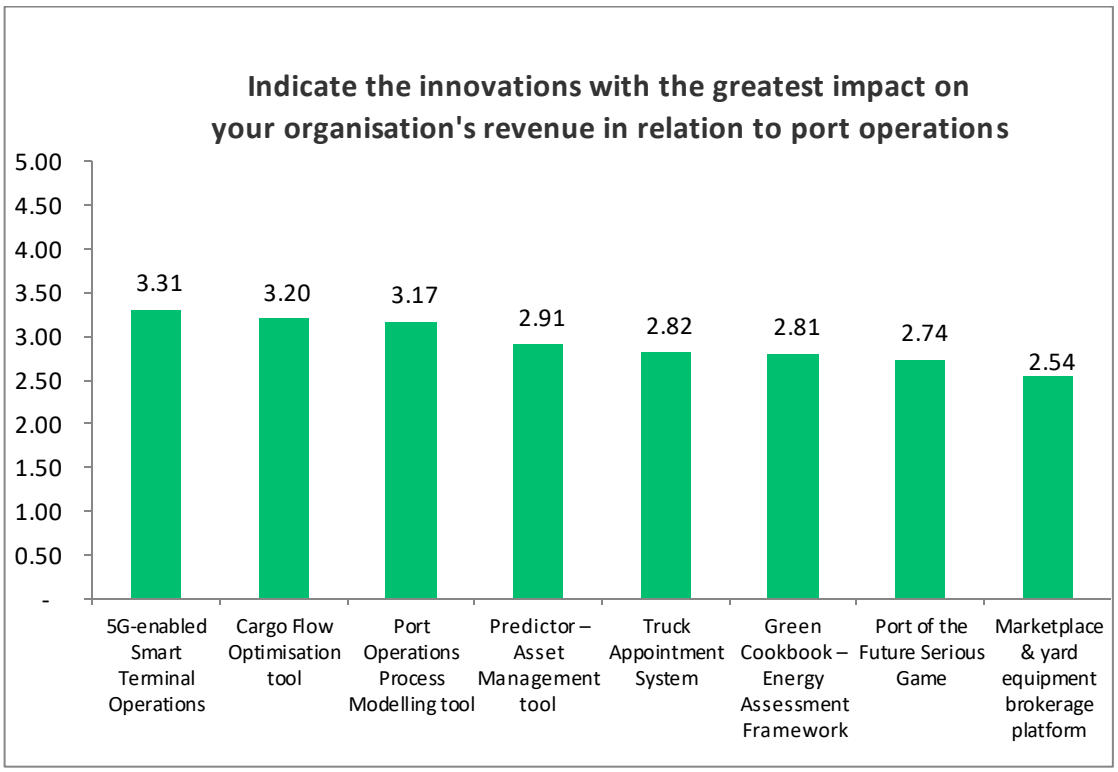


Figure 19 Observed innovation impact on revenue

The survey respondents were also asked to identify the innovations with the greatest impact on the organisation's revenue in relation to port operations (Figure 19). Small deviations among the responses were revealed, indicating 5g-enabled Smart TERMINAL Operations, the Cargo Flow Optimisation tool and the Port Operations Process Modelling tool as the ones that might have a greater impact on the revenue of future organisations.

4.2.1.1 Impact on personnel ranking

The tables below provide conclusions on the ranking of the COREALIS innovations' impact on both personnel and revenue:

Table 2 Observed ranking of innovations impact on Personnel

Impact on Personnel	Weighted Average
Cargo Flow Optimisation tool	3.33
Port Operations Process Modelling tool	3.28
5G-enabled Smart Terminal Operations	3.22
Predictor – Asset Management tool	3.22
Truck Appointment System	2.93
Green Cookbook – Energy Assessment Framewor	2.92
Port of the Future Serious Game	2.89
Marketplace & yard equipment brokerage platform	2.63

4.2.1.2 Impact on Revenue ranking

Table 3 Observed ranking of innovations impact on Revenue

Impact on revenue	Weighted Average
5G-enabled Smart Terminal Operations	3.31
Cargo Flow Optimisation tool	3.20
Port Operations Process Modelling tool	3.17
Predictor – Asset Management tool	2.91
Truck Appointment System	2.82
Green Cookbook – Energy Assessment Framewor	2.81
Port of the Future Serious Game	2.74
Marketplace & yard equipment brokerage platform	2.54

4.2.1.3 Preliminary conclusions

Based on these results, the following conclusions can be made: As far as the impact on personnel is concerned, the Cargo Flow Optimisation Tool and the Port Operations Process Modelling tool are the most significant ones. Revenue -wise, the 5G-enabled Smart Terminal Operations Tool and the Cargo Flow Optimisation Tool are the most significant ones for respondents in terms of impact on revenue. The rest of the Innovations are also identified as business opportunities by the stakeholders.

The survey respondents were also asked to identify the COREALIS innovations that will have the greatest impact on the various categories of KPIs mentioned in section 3.2.6. The responses are presented in the following figures. The figures show the relative amount (%) of respondents that chose for the most important innovation tool.

4.2.1.4 Impact on Climate change

The response is visualised by the following Figure:

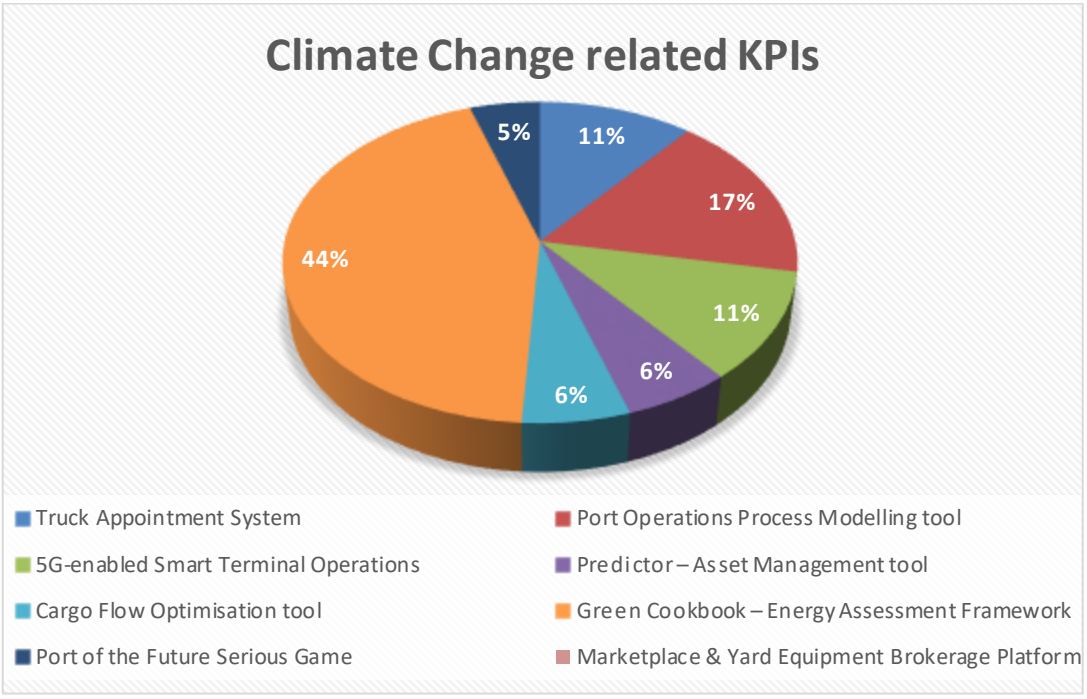


Figure 20 COREALIS innovations impact on Climate Change KPIs

According to 44% of the respondents, the Green Cookbook is considered to bring the biggest impact on climate change. The Port Operations Process Modelling Tool follows next with 17% of respondents and Truck Appointment System with 11%.

4.2.1.5 Impact on Reduced operational and infrastructural cost KPIs

As far as the operational and infrastructural cost KPIs are concerned, 29% of the respondents consider that the Marketplace and chassis brokerage platform have the greatest impact.

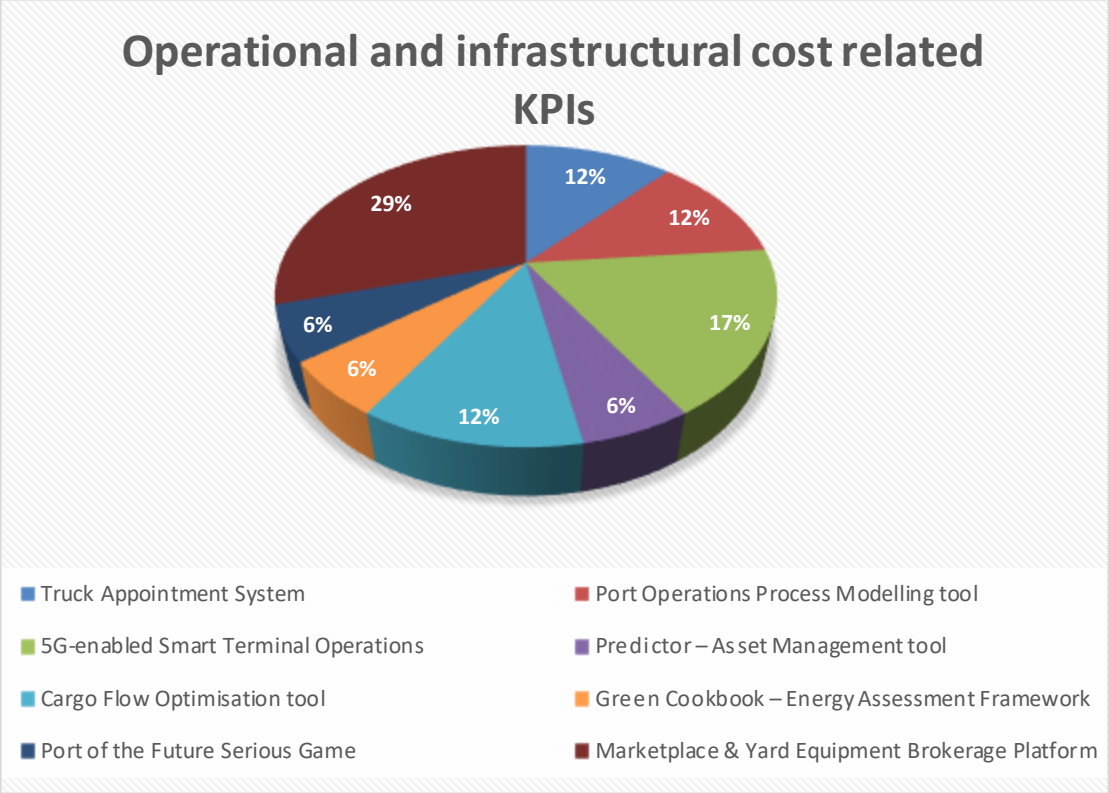


Figure 21 COREALIS innovations impact on operational & infrastructural cost KPIs

4.2.1.6 Impact on Logistics related KPIs

PORTMOD tool, 5G-enabled Smart Terminal Operations tool and Cargo Flow optimisation tool are likely to have the biggest impact on the improvement of logistics efficiency compared to the other innovations.

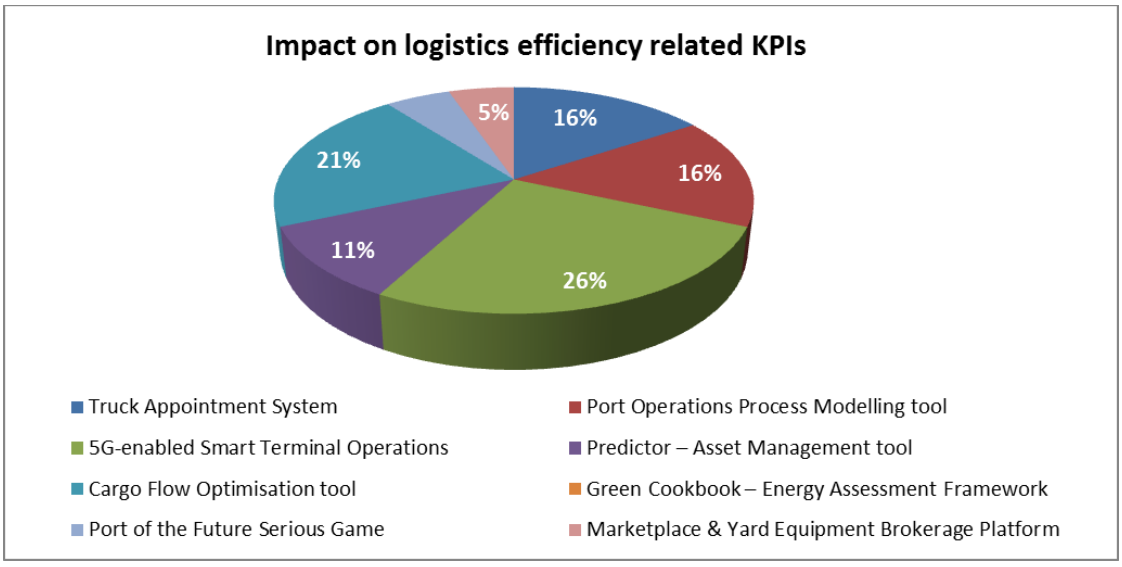


Figure 22 COREALIS innovations impact on Logistics efficiency KPIs

4.2.1.7 Impact on surrounding socio economic related KPIs

The Port Operations Process Modelling tool and 5G-enabled Smart Terminal Operations tool are apparently expected to generate the highest impact on the surrounding socio-economic KPIs.

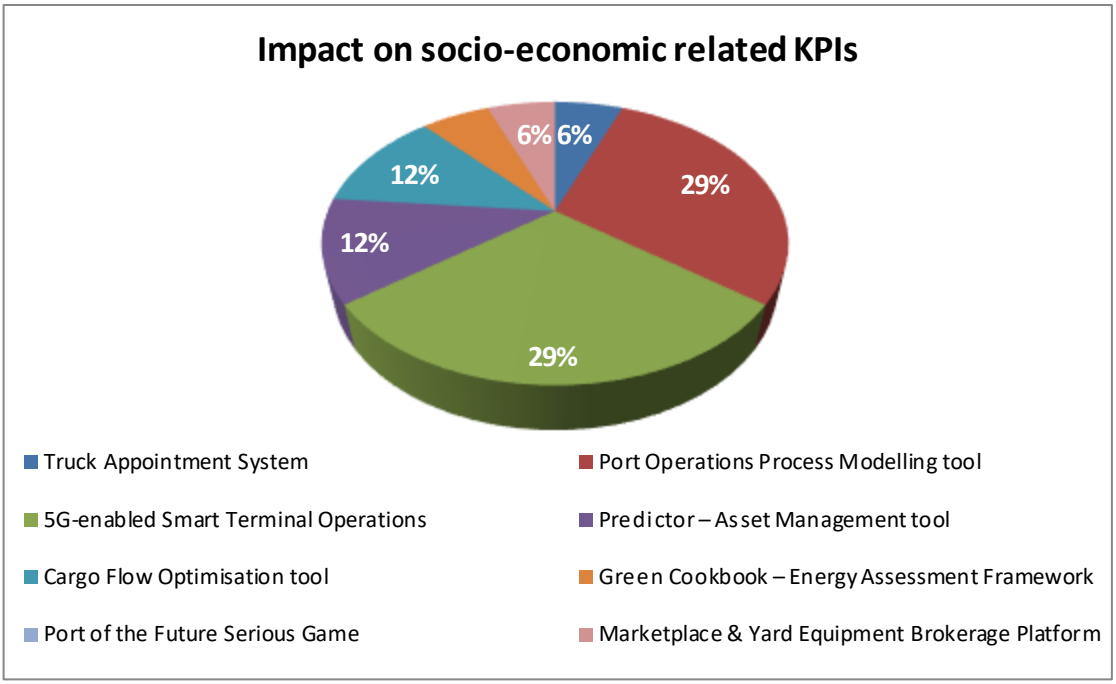


Figure 23 COREALIS innovations impact on Socio-Economic area KPIs

4.2.2 Innovations' impact on applied policies

In this chapter we examine the potential impact of COREALIS innovations on applied policies. Analysis is made by taking the relative amount of respondents that chose the most important innovation tool, impacting specific policies.

4.2.2.1 Impact on Environmental policies

Regarding the impact on environmental policies, respondents expect the most from the Green Cookbook – Energy Assessment Framework serious game.

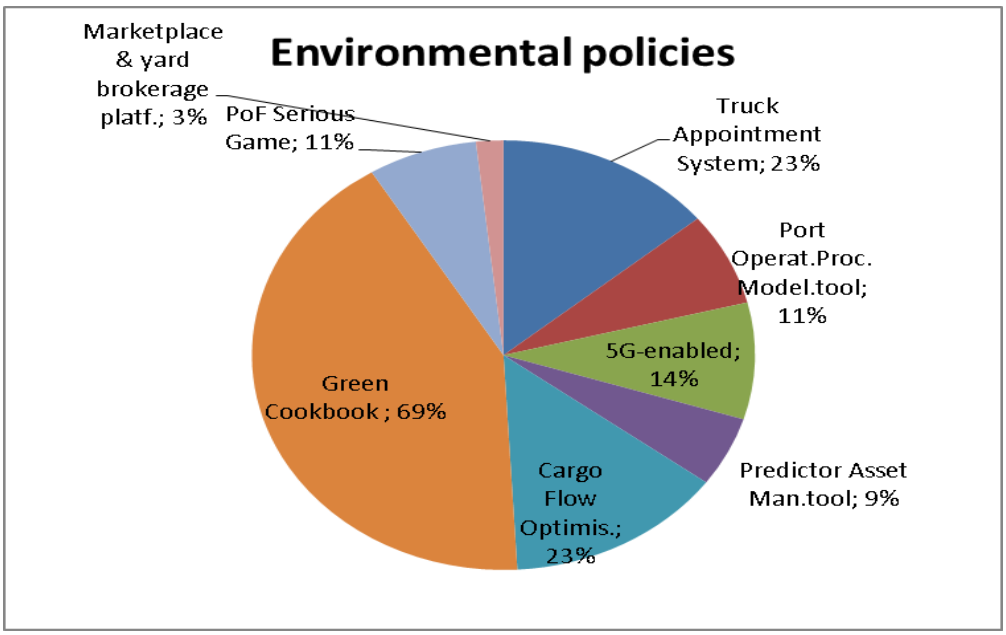


Figure 24 Observed innovation impact on environmental policies

4.2.2.2 Impact on communication policies

Regarding communication policies, respondents expect that the 5G-enabled Smart Terminal Operations will have the greatest impact.

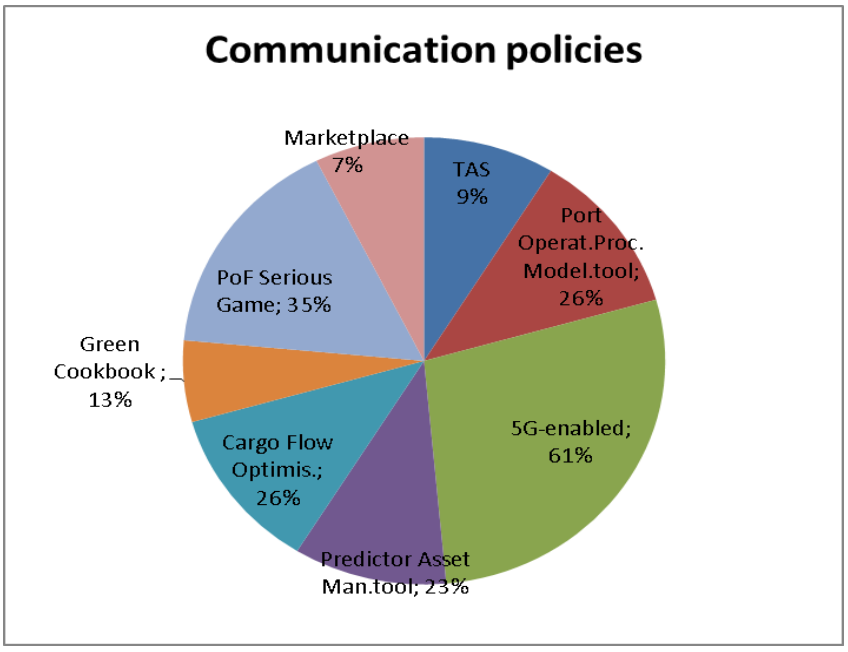


Figure 25 Observed innovation impact on communication policies

4.2.2.3 Impact on transport policies

The Truck Appointment System and the Cargo Flow Optimization tool innovations are likely to have the greatest impact on transport policies.

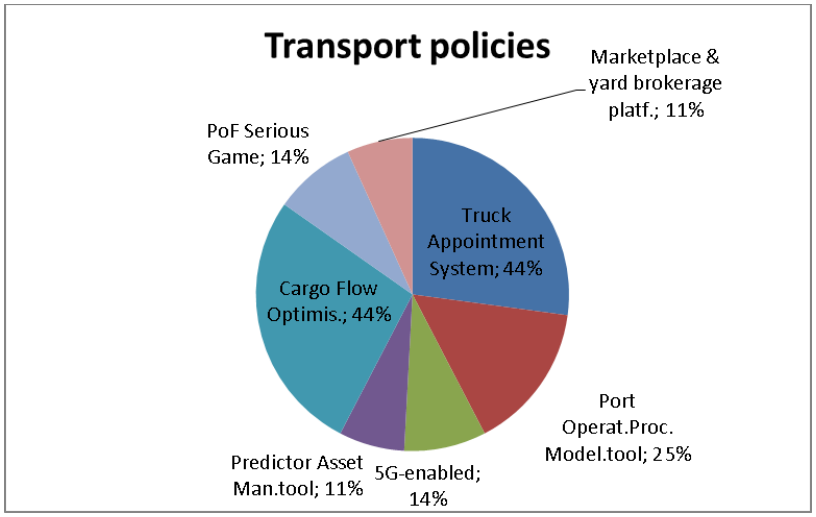


Figure 26 Observed innovation impact on Transport policies

4.2.2.4 Impact on R&D policies

The 5G-enabled Smart Terminal Operations are likely to have the greatest impact on R&D policies.

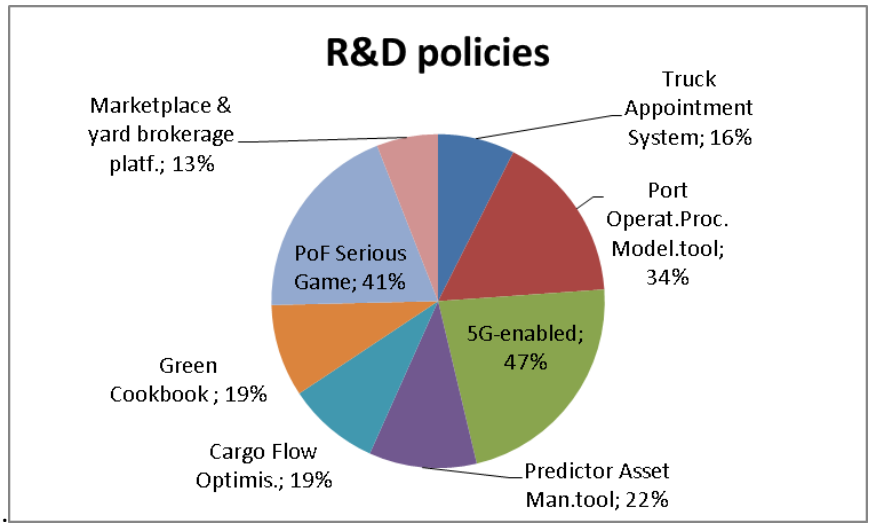


Figure 27 Observed innovation impact on R&D policies

4.2.2.5 Impact on port policies

Regarding port policies, the Port Operations Process Modelling tool will play a substantial role as illustrated in the following figure:

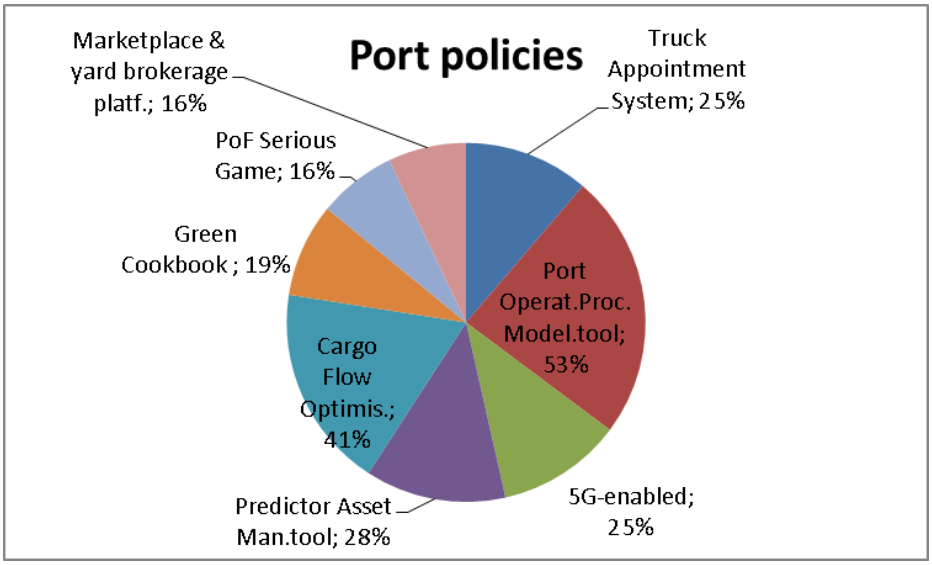


Figure 28 Observed innovation impact on port policies

4.2.2.6 Impact on port city policies

For the port-city policies, Truck Appointment System (33%) and Cargo Flow Optimisation tool play a significant role as stipulated in the following figure below:

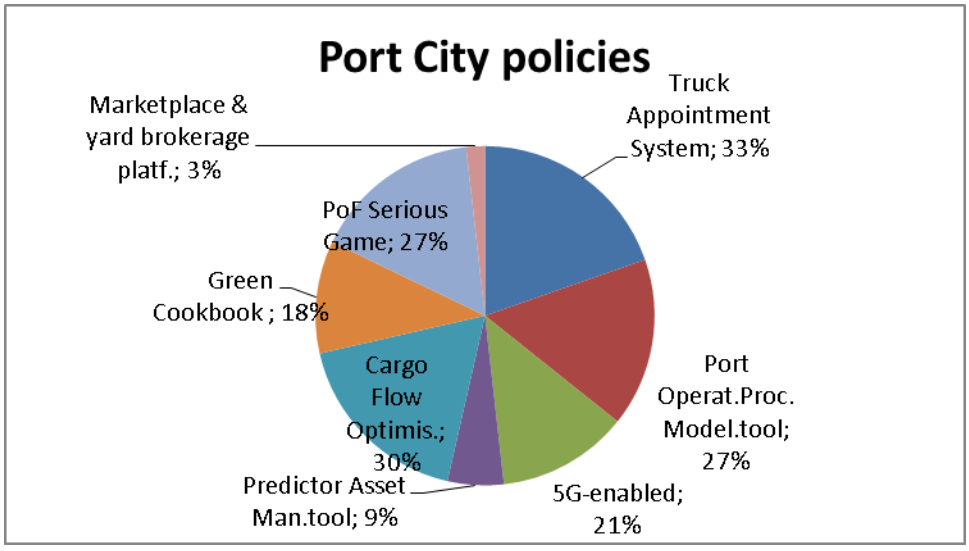


Figure 29 Observed innovation impact on port-city policies

4.2.2.7 Impact on Spatial policies

Respondents consider that Port Operations Process Modelling tool (41%), Cargo Flow Optimisation tool (37%) and Truck Appointment System (26%) are the most relevant COREALIS innovations having an impact on spatial policies.

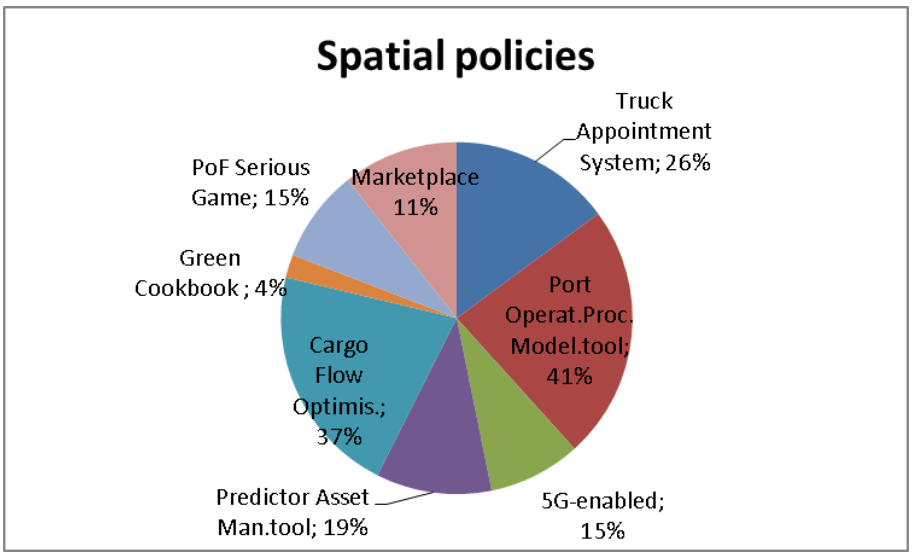


Figure 28 Observed innovation impact on spatial policies

4.3 Correlation between stakeholders' interests and their expectations on the impact of COREALIS innovations

This paragraph links the information out of section 3.1 and section 3.2 together, coming to the insides of stakeholders and related interest in the COREALIS innovations.

4.3.1 Correlation on applied policies and COREALIS innovations impact on these policies

The most important policy to be followed is transport policy. The highest impact on transport policy is given by the truck appointment and cargo flow optimisation tool.

The PoF Serious Game is a good supporting tool since it is expected that it can impact complete policymaking.

4.3.2 Correlation on applied KPIs and COREALIS innovations impact on these KPIs

4.3.2.1 Climate change KPI

Importance of measuring the KPI on climate change varies from measuring today the modal shift towards rail versus measuring CO_2 and noise in 2022. As the innovation with the highest impact on climate change KPI is the green cookbook, it is advised that the cookbook should take care of this change of interest of stakeholders and focus on prescriptions for implementing noise and CO_2 reduction measures, while still indicating more potential solutions for implementing the modal shifts towards rail.

4.3.2.2 Infrastructural cost KPI

This KPI is measured in most cases by observing the reduction in the number of empty container runs. The innovation considered having the highest impact on infrastructural cost is the Predictor – Asset Management tool. It is advised that this tool focuses on the implementations that limit the number of empty container runs.

4.3.3 Correlation between perceived barriers and COREALIS innovations impact

Legislation and societal impact are observed as the items forming the highest barriers for the port related operations. The predictor asset management tool and the PoF Serious game are considered to have the most significant impact on those barriers.

4.4 Statistical representation of this survey

The number of respondents in the survey was 107. Out of this number there were answers skipped and some cleaning of the data needed to be done. The final response rate (94/1346 or about) 7% can be regarded as a normal 'response' rate in in on-line surveys. According to the survey responses, 35% of the overall respondents belonged to the Public sector, 22% came from the Transport sector and 13% of the overall respondents came from the ICT service providers category. Finally, 30% of respondents belonged to the Research, Consultancy and Specialised Companies which has been referred to as "Others" category. For a further categorisation of the respondents, the reader is referred to section 4.1.1 of Deliverable D1.2 [19].

The above conclusions should not be considered as generic ones applicable to all situations, as they come from the input of specific stakeholders and questions was also dependent to the project objectives. Yet, the results are probably indicative on the current barriers, enablers and challenges of European ports as well as the relevance of the project's innovations to them.

5. Complementing interviews and activities

5.1 Aim of the interviews

The initial aim of conducting the interviews was to have more in depth discussions and understanding of the responses from the key respondents. In addition, the initial target was to perform around 50 interviews. However, given the low number of respondents on the questionnaire, we succeeded to have a few interviews, which some of them are reported in full length in the section below.

5.2 Type of questions

The questions were designed to elaborate on information already collected in the online questionnaire. As a result, many of the questions could, in theory, already be answered by the data collected by the online questionnaire. However, these data were useful when conducting the interviews as we were able to have a basic understanding of the stakeholder's perspective.

5.2.1 Generic questions

1. Which stakeholder category does your organisation belong to?
2. What are the main services/products you provide to the port?
3. Describe the platforms that your company offers.
4. You are cooperating with Port X, you are liaising with them on ''daily'' basis, so, what is your relationship with the port? Give us an example of a day interaction (use case).
5. What are your current operational needs and challenges within port (customs for example)?
6. Describe your place in the value chain of the ports business? Do you see any inefficiency?
7. What benefits (port stakeholder community platform) do you get from the port? What benefits do you provide to the port from your service?
8. Describe the opportunities/priorities for your company to incorporate the PoF innovations.
    a. TAS Truck Appointing System
    b. The COREALIS PORTMOD (Port Operations Process Modelling tool)
    c. The COREALIS RTPORT (5G-enabled Smart Terminal Operations – Model-Driven Real-Time Control Model)
    d. The COREALIS Predictor – Asset Management
    e. The COREALIS Cargo Flow Optimiser (Cargo Flow Optimisation Tool)
    f. Green Cookbook – Energy Assessment Framework
    g. Port of the Future Serious Game
    h. Marketplace & Yard Equipment Brokerage Platform

The format of the questions for complementing interviews allowed to participants a degree of flexibility to answer several questions at the same time. Therefore, additional useful insights were gained from interviews as a result of these generic questions. Interviews resulted with a deeper understanding on specific port dynamics and the nature of their business relationships.

5.2.2 Public authority questions

Additional questions were drafted for public authority stakeholders, as they face slightly difference challenges and are typically the owners or policymakers of ports.

- Do you have common policy goals agreed between the port and the city? E.g. related to Vision 2030 exchange of traffic management information (traffic related info).
- What kind of relationship do you maintain with your port? Is it a public, private or PPP port? What kind of contract do you have with the port?
- Do you have any plans to redesign the port with public interest in mind? E.g. Museum, mall.
- Do you receive any KPIs? E.g. Corporate Sustainability for the port.

5.3 Analysis on the interview responses

Some responses were collected after telephone interviews. In total, four personalised interviews were carried out successfully despite significant attempts to contact other participants. This has been made even more complicated by the fact that not all participants completed the online questionnaire in its entirety, or provided their contact telephone number, which meant we could only follow up with a limited number of participants.

This aside, some insights were gleamed from the interviews and all participating respondents were very helpful. Of the four successfully completed interviews, they represented the following organisations:

- City of Helsinki (City Council)
- ITS Deutschland (Involved Ministry)
- Info.era (an ICT Service Provider)
- Interporto di Trieste S.p.A.(Port Terminal)

ERTICO managed to talk with a broad range of stakeholders, allowing us to understand the challenges Ports face from many perspectives. In total, 3 ports were represented – Helsinki, Hamburg and Trieste, with all of the stakeholders maintaining daily or weekly interactions with the port.

5.3.1 Interview 1

The first interview was with representatives of the City of Helsinki's Council who are owners of the port. The port maintains its own bespoke ICT service platform called PORTNET,

launched in 1994 which has been updated over the years and is compatible with other port software systems. However, the companies and businesses operating within the port maintain their own ICT systems.

The main challenge they face at the moment is passenger traffic. Helsinki is the second busiest passenger port in the world and thus it receives a lot of traffic. The main issues associated with this are the hinterland transportation connections.

The port also faces a positive problem – the growth of the cargo business. The interviewee indicated that many of the COREALIS innovations would be helpful. At the moment they are trying to implement an arrivals system for the port which can manage truck parking e.g. timeslots. They have been able to develop their own specific automatic mooring system which enables ships to dock and unload within one hour (an automatic system which uses magnetics and computers to calculate the approach speed and force needed to dock).

Finally, because the stakeholder represents a public authority, further questions were directed to them. They indicated that while they do not collect traffic data, they do facilitate its communication throughout the port as their main objective is to improve the ports efficiency. Having said that, currently there is not a holistic solution that can encompass the broad range of software being used by the port stakeholders and there has been no push to pursue one.

Finally, when it came to plans to redesign the port with the public's interest in mind, they indicated that this has already been broadly achieved and it is an ongoing activity. The port is already very popular as a tourist destination and is full of markets, shops and restaurants.

5.3.2 Interview 2

The second interview has been conducted with a representative from **ITS Deutschland**, who indicated that their organisation provides consultation and advice as well as internal platforms for public authorities. The main port their organisation interacts with is Hamburg, while they do work with other ports, they were also concerned with internal waterway transportation e.g. canals.

The main role of this organisation in the port, is the one of traffic information manager, especially in regards to the coordination of truck traffic to and from ports. At the moment they are developing applications and software solutions to enable a smoother operation within the port. Given that, this is a global issue for ports, they view the development of these apps as a significant opportunity to grow and expand.

Furthermore, take into consideration their role as a public authority, the representative said that Hamburg is unique because the city and the port are the same single authority. As a result, the representative argued that they would be able to more easily improve coordination among the various actors and port stakeholders.

5.3.3 Interview 3

The third interview was held with a representative of **Info.era** an **ICT service provider** operating in the port of Trieste. The company provides port community systems such as SINFONAR, and supports the port on a daily basis. Their company manages vessels in general, both container and other vessels, road transportation including complete units, semitrailers as well as rail connections. Furthermore, they also manage and support customs operations. The stakeholder indicated that the biggest challenge they face is to create cooperation among the various actors and port stakeholders.

As the port's key service provider, they manage all traffic going in and out of the port and to the city and have been successful in improving efficiency using systems such as the aforementioned SINFONAR. They also provide an interface for truck drivers which interact with the port allowing them to avoid congestion. This is also accomplished by using a traffic light like system which indicates parking availability for trucks.

5.3.4 Interview 4

The fourth interview was held with a representative of **Interporto di Trieste,** a port terminal operator. In addition to the services normally provide by a port terminal, Interporto di Trieste offers different services e.g. parking area service for trucks, warehouses services, and railway connections.

The main challenge they face is managing the traffic flow of trucks, and they indicated that they would be interested in the PoF TAS innovation.

Furthermore, Interporto di Trieste recently acquired more land around the port and is looking to expand their services and facilities, particular trucks and railway connections.

5.3.5 Conclusions from the interviews

Reading the interview responses, they are in line with the conclusions made before. The interviews revealed a lot attention from the ports dealing with the appointment of trucks and the internal operational management of the goods within the port. One could conclude that the most important COREALIS innovations that seem to be of significant interest of the interviewee are the **Truck Appointment System** and the **Cargo Optimisation tool**, as concluded in the analysis sections as well.

5.4 Special interest Session at the ITS World Congress

In order to complement this deliverable, ERTICO organised a workshop called PORT OF THE FUTURE TOWARDS AUTOMATION in the context of the ITS World Congress on Thursday 20 September 2018. [4]This session brought ports around the world, solution

[4] https://itsworldcongress.com/media/news/ports-of-the-future-event-at-itswc18/

providers and public authorities together to discuss the ''future trends'' of the next generation port focusing on hinterland connections, automation technologies like truck platooning for ports, terminals and highway.

The logistics industry is one of the later industries to jump on the automation, embracing opportunities to reduce operating costs and optimise efficiency and space for terminal operators. Automation can bring a new way to manage container terminals, addressing many different levels of the business too including the improvement of the efficiency of the movement of cargo into and out of a terminal.

This session presented several technological innovations in the context of but not limited to the COREALIS Port of the Future project and stimulated the discussion around user needs for the Port of the Future Panel. ERTICO invited a diverse community of panellist's including the Port of Hamburg, Port of Qingdao, Port of Livorno, T-Systems International GmbH, CISCO, and VOLVO whilst the moderator was ICCS. The session gathered a great number of attendees and was positively assessed. The panel was asked to present innovations addressing current challenges in ports and bring examples of best practices based on the list of innovations suggested in COREALIS project:

The panellists highlighted concrete examples on:

1) Predictive Asset Management

2) 5G-driven Situational Awareness

3) Circular-economy based Fleet management

4) Analytics-driven Cargo Flows Optimisation

5) Port-City Decision Making via Serious Gaming

6) Optimisation of a Container Terminals' Energy Profile

7) Port of the Future as Innovation Incubator

8) Truck Appointment System

The audience was also asked to contribute through a real time survey. Panellists highlighted the importance of involvement of various stakeholder categories in COREALIS project in order to foster the implementation of COREALIS innovations and proper involvement of port stakeholders, transport & logistics operators and ICT companies among others can have a significant impact on the Port of the Future operations.

Among key messages from this session was the need for creating real solutions for the Ports of the Future as well as fostering innovation and transformation of processes. Other aspects discussed were intelligent scheduling algorithms and yard plans, monitoring platforms based on IoT, connecting the Ports through AEOLIX project and cooperation with other ports along Silk & Maritime Road & Northern Sea Route.

From vehicle manufacturers present during this session was the introduction of VERA -, an autonomous vehicle that forms part of a larger system with potential to optimise transport in highly-repetitive, short distance flows with large volumes of goods (ports, factory areas & logistics mega centres).

Several mobile network operators have also expressed their interest in COREALIS project as some of them are developing a broad portfolio to support E2E logistics needs, IoT for shipment & monitoring of goods, asset inventory, automated ordering in/outgoing goods and want to be part of Digital Intelligent Hubs.

6. COREALIS Personas

A persona is a fictional character that represents a group of users/stakeholders (Cooper, 1998)[5]. The personas are meant to represent archetypical users of the projects artefacts and were used in the streamlining phase for developing user stories associated to each requirement.

Through discussions with COREALIS ports and their stakeholders, a preliminary set of 5 COREALIS Personas had been identified by the Consortium during the proposal phase. This was an initial representative selection of persons/roles that have a direct impact to or from the port-city operations within the surrounding urban space. The initial list of personas are presented in Figure 29.

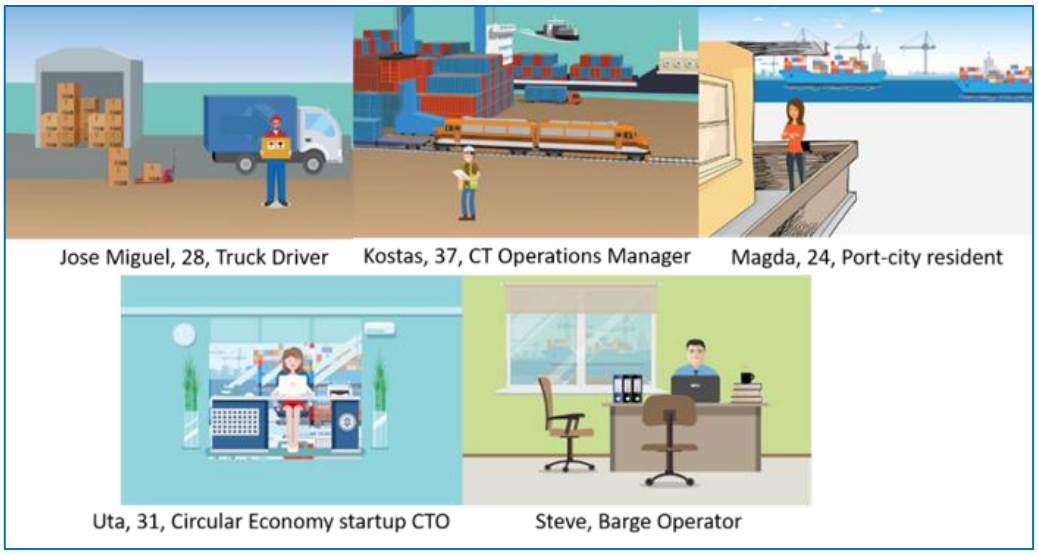


Figure 29 The initial set of COREALIS personas

By mapping and prioritising the stakeholder list, the 5 preliminary COREALIS personas described above were revised and extended to a larger, yet manageable set of personas. Around those representative personas, the scenarios describing the implementation of the project innovations in the 5 LLs will be developed and implemented.

Starting from the outcomes of the focus groups and interviews with relevant stakeholders, 12 personas have been identified and are described in the following set of figures.

[5] A. Copper (1998). *The Inmates Are Running the Asylum: Why High-Tech Products Drive Us Crazy and How to Restore the Sanity*, Sams - Pearson Education.

Jose Miguel
Truck Driver
Age: 28

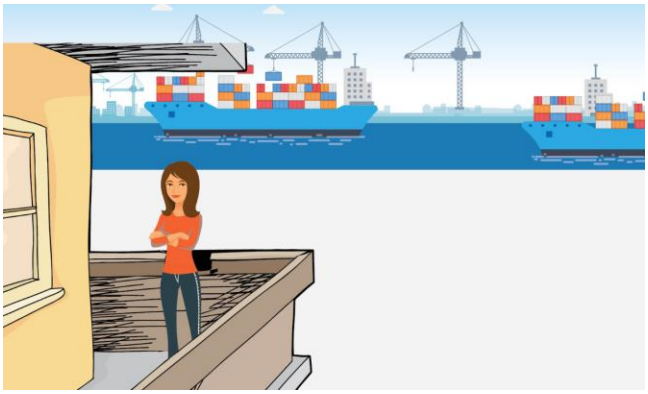
Jose is a driver for a local shipping company.
He picks up and delivers cargo in a tractor trailer every day and selects the most efficient routes in compliance with delivery instructions and fuel policy. He also obtains signatures needed and updates all necessary paperwork regarding shipments. Jose is concerned with the increasing traffic and congestion around the port during peak hours.

Figure 30 COREALIS persona: Truck driver

Costas
Operations Manager
Age: 37

Costas is responsible for the efficient use of port facilities and resources. He takes charge of managing vessel loading and discharge with specific responsibilities for health and safety and security. He is also managing staff, and liaising with port users.

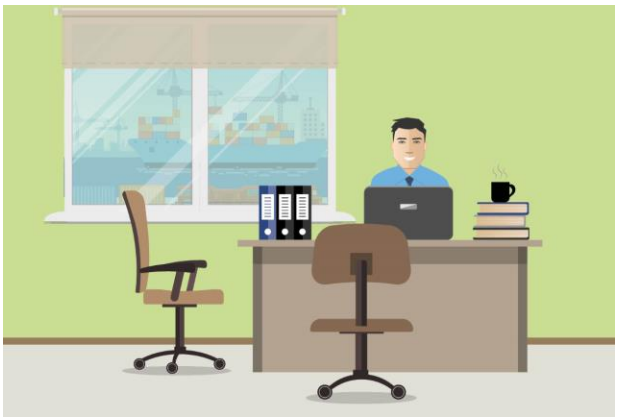
Figure 31 COREALIS persona: Operations Manager



Magda
Port city resident
Age: 24

Magda is living nearby the port area. She is a college student and takes her car to go to the University every day with her bike. She is frustrated by the congestion aound the port during peak times. She uses smartphone apps to watch traffic and avoid congested routes whenever possible.

Figure 32 COREALIS persona: Port-city resident



Steve
Barge Operations Manager
Age: 42

Steve implements the barge loading and discharging plan. He monitors barge status and reacts to changes in vessel systems. He is also responsible for completing verification assurance and routine activities and maintaining accurate records.

Figure 33 COREALIS persona: Barge Operations Manager

Tom
Lifting Equipment Operator
Age: 44

Tom is responsible for unloading equipment and containers from vessels, stacking them to assigned places and moving stock of products to pallets or crates for storage or shipment. He performs a Q/A control check once he starts operation.
He would like to be able to get physical information about general cargo in order to map it into appropriate yard slots and facilitate the delivering/picking operations.

Figure 34 COREALIS persona: Lifting Equipment Operator

Helen
Policy-maker
Age: 42

Helen makes big decisions that affect the community and its future with emphasis on Municipal Governance and Institutional Capacity Strengthening.
Favours modern, effective low-cost solutions and believes in technology driven change.
She understands the benefits of fostering civic engagement and community spirit but does not have prior experience in port-city hinterland connection.
Has many contacts and is involved in key networks at local and regional level.

Figure 35 COREALIS persona: Policy-maker

Peter
Technical Manager
Age: 38

Peter specializes in Optimization Software to improve operational decision making at the port. He is also planning the maintenance schedule and spare part purchases.

Figure 36 COREALIS persona: Technical Manager

Hanna
Freight Forwarding Manager
Age: 42

Hanna is responsible for coordinating the processing of incoming and outcoming shipments. She thinks that the efficiency of the company's daily operations would increase by shifting to more sustainable modes and by combining the transport demand with competitors. She is also interested in the possibility of using new routes or transport services and increase occupation of existing ones.

Figure 37 COREALIS persona: Freight Forwarding Manager

Liam
Rail Operator
Age: 53

Liam has experience of technical and leadership experience in rail covering track, fleet, operations, stations and communication. He is in charge of managing the cargo for the rail services. He sees benefit in connection with the port and increase its modal split and is involved in a project for the upgrade of rail infrastructure.

Figure 38 COREALIS persona: Rail Operator

Nico
Customs Officer
Age: 39

Nico has extensive knowledge of customs laws and trade agreements to optimise importing and exporting costs. He ensures that freight moving via the port is cleared for transportation. He also monitors compliance with regulations within a variety of business premises including ensuring that appropriate duty is paid.

Figure 39 COREALIS persona: Customs Officer

Uta
Start-up CTO
Age: 31

Uta is the chief technology officer of a start-up aiming to use innovative technologies to disrupt supply chains. She is mostly interested in the promotion of circular economy, renewable energy and sustainable operations in ports.

Figure 40 COREALIS persona: Start-up CTO

Alex
Yard Equipment Manager
Age: 50

Alex's responsibilities include the scheduling, maintaining, and dispatching of all yard equipment. This includes the tracking and knowledge of the port's assets at all times. He is also responsible for inspecting and performing maintenance of forklifts and other material handling equipment.

Figure 41 COREALIS persona: Yard Equipment Manager

7 Conclusions

This report aims to list and classify the stakeholders that constitute the ecosystem of a smart port and its surrounding urban space, indicating their business/operational profile and the area(s) of intervention and interaction with the COREALIS framework and innovations.

For this purpose, an electronic questionnaire has been created with the aim to characterise all related relevant stakeholders to the port's operation in a port-city context. This questionnaire also interviewed the stakeholders' opinion on how the COREALIS innovations would impact their port-related business. The parameters examined included applied business KPIs, policies, business enablers, barriers and challenges.

Complementary telephone interviews were organised to get more information and deeper insights on the responses. The information obtained from these interviews was in line with the preliminary conclusions that were derived from the questionnaire responses. From participation in the Focus Groups important elements were also collected for the classification of the stakeholders and the significance of their role in the deployment of innovative solutions.

By mapping and prioritising the stakeholder list, the 5 preliminary COREALIS personas identified during the proposal phase were revised and extended to a set of 12 personas, significant for the port ecosystem. Around those representative personas, the scenarios describing the implementation of the project innovations in the Living Labs will be developed and implemented.

The data analysis also laid likelihood explanations and conclusions on the impact of the COREALIS innovations on business related aspects (KPIs, policies, etc). Further analysis of the questionnaire responses highlighted the fact that businesswise, the COREALIS innovations with the most impact as perceived by stakeholders, are the Truck Appointment System and the Cargo Optimisation tool. Among the most critical elements for the uptake of innovative, integrated and sustainable solutions, visibility and interoperability of systems emerged during discussions in the Focus Groups. An increase of visibility of train and barge capacity and availability would already increment the quantity of cargo distributed over rail and inland waterways with immediate reduction of congestion around the port. A shift towards increased visibility and eventually interoperability of systems across transport modes, would be possible through cooperation of different stakeholders and policy support to data sharing. Finallly, the COREALIS innovations such as the Port of the Future Serious Game, will likely be useful tools to stimulate these discussions.

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[5] https://ec.europa.eu/inea/en/horizon-2020/projects/h2020-transport/infrastructure/corealis

[6] https://www.corealis.eu/

[7] https://itsworldcongress.com/media/news/ports-of-the-future-event-at-itswc18/

[8] https://twitter.com/AEOLIX_Platform/status/1042751083897151488

Annex 1: Explanatory list of COREALIS innovations

1. The COREALIS Green Truck Initiative

   a) Truck appointing system referred as well as TAS – "Truck Appointment System"

   An innovative Truck Appointing System (TAS) for external trucks that are calling in the port to deliver or pick-up containers. The system intends to minimise waiting time at the port gates, providing to the drivers an optimal time-window to enter the port based on preference, vessel schedules, the traffic expected from other trucks and real-time data from the urban TMC.

   b) The Marketplace and chassis brokerage platform referred as "Marketplace & Yard Equipment Brokerage Platform"

   A marketplace/cloud-based brokerage platform will facilitate swift and seamless interactions among the port and the leasing entity, allowing online booking of chassis and serving as a hub for operational data. The marketplace will comprise i) A catalogue of services for ports and their clients so that ports and their clients can book equipment or services for a given time, ii) Yard equipment pool management with emphasis on chassis or other relevant for the CT, iii) Spot booking, and iv) Rating/benchmarking of service providers from the port operators

2. The COREALIS PORTMOD referred as "Port Operations Process Modelling tool"

   Process modelling of cargo and data flows in CTs can improve their competitiveness by more efficient operations and better compatibility with regulations. The focus of the PORTMOD modelling tool will be operational efficiency, safety for personnel, emission analysis using LIPASTO databases and improved data sharing (e.g. via a PCS). In practice, PORTMOD describes in detail the container placements in the container movement chain.

3. The COREALIS RTPORT (Model-Driven Real-Time Control module) refereed as "5G-enabled Smart Terminal Operations"

   Model-Driven Real-Time Control module (RTPORT) will coordinate and support port operation, providing measurable feedback to the models of PORTMOD. It will perform real time control of operations collecting data via yard vehicles and implanted sensors (including cameras), taking operating decisions based on on-line analytical processing and PORTMOD models.

4. The COREALIS Predictor – Asset Management referred as "Predictor – Asset Management tool"

   An efficient asset management requires an optimal use of port assets, e.g. yard vehicles (forklifts, cranes and trucks), tyres and spare parts. Storing and managing bulky assets takes up significant space of the port. The Predictor tool goes beyond

classic ERP static preventive maintenance tools by realising a powerful predictive analytics module; this enables monitoring and dynamic prediction of the total life-cycle cost of port assets that improves over time.

5. The COREALIS Cargo Flow Optimiser referred as "Cargo Flow Optimisation tool"

   It is an innovative data-analytics based cargo flow optimisation component; AIS data for the vessel ETAs will be multiplexed with (big) data from the rail operators and barges ETAs so that cargo flows are streamlined; the aim is to minimise containers' waiting time at the port. This process will improve current land/infrastructure use and the overall supply chain connection to the port. Besides, through innovative machine learning, cargo flow prognoses for short-, mid- and long-term will be implemented so that the port managers and urban planners may be facilitated in their infrastructure investment planning.

6. Green Cookbook – Energy Assessment Framework

   The Green cookbook helps ports to lower their environmental footprint and move to cleaner transport modes and cleaner energy sources.

7. Port of the Future Serious Game

   The Port of the Future Serious Game (PoFSG) is an innovative and interactive training and simulation tool that is used to assess the feasibility and sustainability of the socio-economic and environmental/physical development of a port within the surrounding coastal and urban area. The tool will visualise the anticipated impacts – positive and negative – related to social, economic, and environmental aspects.

Annex 2: COREALIS identified policies list

- **Environmental policies:** the commitment of an organisation to the laws, regulations, and other policy mechanisms concerning environmental issues. These issues generally include air and water pollution, waste management, ecosystem management, maintenance of biodiversity, the protection of natural resources, wildlife and endangered species.

- **Transport policies:** the commitment of an organisation to the laws, regulations, and other policy mechanisms concerning transport challenges related to Road, Air, Rail and Maritime transport. These challenges generally include congestion, oil dependency, greenhouse gas emissions, infrastructure, etc.

- **Port city policies:** The development of port-cities is analysed in relation to its port activity. As such, two sets of indicators are considered, one related to the port development (Creation of maritime clusters Attraction of port-related headquarter functions Economic diversification policies Creating synergies between port and other clusters Coordination between ports Cooperation with neighbouring port-cities), the other related to the development of the city (metropolitan population size and revenue per capita, both in level and growth, unemployment rate, and more specifically related to port, direct and indirect port employment, and labour productivity of the port)

- **Port policies:** Port policies are focused on promoting high cargo handling volume growth in ports. They include a wide range of actions ranging from planning long-term strategic development, developing activities on port sites, new port functions, port information, modernising port-terminals, good labour relations and upgrading skills.

- **R&D policies:** R&D policies are focused on regulating the work (intellectual property rights, Standards, Patents, Technology transfer, etc.) a business conducts toward the innovation, introduction and improvement of its products and procedures, layi ng on investigative activities:
    - Synthesise and theorise,
    - explore, hypothesise and clarify,
    - design and develop and test,
    - Implement Study efficacy and improve.

- **Spatial policies or open space policies:** this policy outlines the City's commitment to the provision and maintenance of open space for the recreational and leisure needs of the community.

Annex 3: COREALIS related KPI list

Climate change

CO2 reduction and Energy strategy

- Reduction in CO2 emissions
- Reduction in the noise generated by trucks calling in the port to pick up or deliver containers
- Improvement of modal split in favour of rail and inland waterway
- Improvement in ports investing in smart-grid technology and green energy sources; for such ports a subsequent
- Increase of relying only to sustainable energy sources, and over; Climate change related KPIs measured in PoFSG (flood risks, vulnerability of critical infrastructure to extreme weather)

Reduction in their operational and infrastructural costs

- Reduction in the empty container runs
- Better use of the yard due to improved stacking
- Reduction of false-positives/negatives as regards to replacement/renewal decisions for assets
- Reduction of operational and maintenance costs of the port spare parts, including tyres
- Reduction in the trucks and yard equipment idling for more than one shift

Improvement of logistics efficiency

- Reduction of the time a container stays in the port prior to being handed over to another transport mode
- Lower unit cost in the end-to-end supply chain due to the estimated improvement of modal split to rail

Better integration of the port in the surrounding socio-economic area, including city-port relations and the smart urban development of Port Cities

Number of urban area stakeholders engaged in initiatives and discussions about port-city challenges and common approaches/roadmaps to tangibly deal with them; At least 20 SMEs/start-ups applying for COREALIS open call for innovation in the respective LL, of which at least three are awarded a start-up innovation funding scheme;

Number of EU ports adopting green cookbook guidelines for becoming a smart energy prosumer in the local urban space.

Entail attention to environmental and climate-related concerns.

Commitments from the involved ports and port-cities, and associated COREALIS partners for:

- Emission reduction
- Noise reduction
- Take-up of the use of renewable energy sources
- Inclusion of climate change related
- Number of jobs related to renewable energy and circular economy principles in port-cities

Annex 4: COREALIS list of policies

List of Policies

1. Environmental policies
2. Transport policies
3. Port City policies
4. Port policies
5. R&D policies
6. Spatial policies
7. Communication policies

Annex 5: GDPR

Personal Data Protection

In the context of the European Union's Horizon 2020 Programme for Research and Innovation, the COREALIS project has received funding under Grant Agreement No. 768994, which was signed between INSTITUTE OF COMMUNICATION AND COMPUTER SYSTEMS (ICCS) and the COREALIS Consortium, consisting of the following partners:

1. INSTITUTE OF COMMUNICATION AND COMPUTER SYSTEMS (ICCS)
2. STATHMOS EMPOREVMATOKIVOTION PEIRAIA AE (PCT)
3. NAYTILIAKES METAFORIKES KAI EPIKOINONIAKES EPIXEIRISEIS SEABILITY EPE (SEAB)
4. EUROPEAN ROAD TRANSPORT TELEMATICSIMPLEMENTATION COORDINATION ORGANISATION - INTELLIGENT TRANSPORT SYSTEMS & SERVICES EUROPE (ERTICO)
5. FUNDACION DE LA COMUNIDAD VALENCIANA PARA LA INVESTIGACION, PROMOCION Y ESTUDIOS COMERCIALES DE VALENCIAPORT (VPF)
6. MOSAIC FACTOR SL (MOSAIC)
7. Teknologian tutkimuskeskus VTT Oy (VTT)
8. STICHTING DELTARES (Deltares)
9. NEC LABORATORIES EUROPE GMBH (NEC)
10. SGS SOCIETE GENERALE DE SURVEILLANCE SA (SGS)
11. DYNNIQ NEDERLAND BV (DYNNIQ)
12. HAVENBEDRIJF ANTWERPEN (POA)
13. CONSORZIO NAZIONALE INTERUNIVERSITARIO PER LE TELECOMUNICAZIONI (CNIT)
14. AUTORITA DI SISTEMA PORTUALE DEL MAR TIRRENO SETTENTRIONALE (AdSPTS)
15. ERICSSON TELECOMUNICAZIONI (ERICSSON)
16. MARLO POLAND SPOLKA Z OGRANICZONA ODPOWIEDZIALNOSCIA (Marlo)
17. STEVECO OY (Steveco)

Purpose of data collection

This particular activity to which you are invited to participate today relates to data collection and analysis regarding the evaluation and adoption of the most appropriate practices for the Ports of the Future. Your personal details will be collected by the COREALIS consortium members via this questionnaire.

Types of data collected

The personal data that will be collected during this activity includes the name, email address and role/profession of participants. The consortium will pursue to minimise the amount of personal data collected through this activity.

Data storage and retention

Your personal data will be collected by the COREALIS consortium, stored at the COREALIS members storage systems and will be maintained until the end of the project.

Data processing and lawful basis for processing

The COREALIS consortium members will process your data, collected on the basis of consent, via the present questionnaire.

Voluntary Participation

The participation in this campaign is voluntary. You may choose not to take part or subsequently cease participation at any time.

Right to withdraw consent

You have the right to withdraw your consent at any time by emailing to <details of data controllers> your contact details (i.e. name, email address), using as subject *"Request to withdraw consent from the project"*. The data provided, up to the moment of withdrawal (of consent), can be used in the project. In case you wish to withdraw your consent, the data processing will be terminated. However, you cannot withdraw consent to processing that has already taken place.

Right to lodge a complaint

You have the right to lodge a complaint with the Hellenic Supervisory Authority, without prejudice to any other administrative or judicial remedy, if you consider that the processing of your personal data infringes the provisions of GDPR regulation.

Right of access

You have the right to access your personal data and supplementary information (i.e. purposes of processing, the data types collected, etc.) at any time, by emailing to <details of data controllers> your relevant request and contact details (i.e. name, email address) and, using as subject *"Request to data access from the project"*.

Right to rectification

You have the right to obtain from <entity> and without undue delay the rectification of inaccurate personal data concerning yourself, by emailing to <details of data controllers> your relevant request and contact details (i.e. name, email address) and, using as subject *"Request to data rectification from the project"*.

Right to erasure

You have the right to request the deletion or removal of your personal data without undue delay, by emailing to <details of data controllers> your relevant request and contact details (i.e. name, email address) and, using as subject *"Request to data erasure from the project"*.

Right to restrict processing

You have the right to 'block' or suppress processing of your personal data, by emailing to <details of data controllers> your relevant request and contact details (i.e. name, email address) and, using as subject *"Request to data restrict processing from the project"*.

Right to data portability

You have the right to obtain and reuse your personal data for your own purposes across different services. In case you need a copy of your personal data, you have to email to <details of data controllers> your relevant request along with your contact details (i.e. name, email address), while using as subject *"Request to data portability from the project"*. In such cases, we will provide you with your personal data in a structured, commonly used and machine-readable form, free of charge and within 1 month upon reception of your relevant request.

Project Informed consent form for workshops

You are being asked to participate in a research study for the COREALIS project. Participation is completely voluntary. Please read the information about the project, its aims, and the gathering of user requirements and needs in the project's Information Sheet and ask questions about anything that you do not understand.

I, the undersigned, confirm that (please tick box as appropriate):

1. I have read and understood the information about the project, as provided in the project's Information Sheet.	
2. I have been given the opportunity to ask questions about the project and my participation.	
3. I voluntarily agree to participate in the project.	
4. I am aware of the data that will be collected during this activity.	
5. I understand I can withdraw my consent regarding my participation in the project any time without specific reasons. Such withdrawal shall be given as easy as I gave my consent. I understand I will not be penalised for withdrawing my consent nor will I be questioned on the reasons of such withdrawal.	
6. The procedures regarding confidentiality have been clearly explained (in this case anonymisation of data) to me.	
7. If applicable, separate terms of consent for interviews, audio, video or other forms of data collection have been explained and provided to me.	
8. It is clear to me that my data will be processed with regard to research, publications, sharing and archiving purposes. I understand that at the end of this project my data will either be destroyed or reused only upon my consent.	
9 Select only one of the following: • I am above 16 years old and no parental consensus is required. • I consent voluntarily for my child to participate as a participant in this study.	
10. Select only one of the following: • I agree my name to be included in reports, publications and other research outputs of the project as well as any other information I have provided. • I do not wish my name to be included in this project.	
11. I agree to sign and date this informed consent form.	

Participant:

Company/Organisation:

Role:

Email:

Date:

Signature: